STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

Request For Bids For Construction Services

Two-Stage Bidding Process

Stage II
Invitation to Bid – Roofing Contractors Bidder's List

February 21, 2006

ROOFING, MECHANICAL, ELECTRICAL, AND WINDOW IMPROVEMENTS OGDEN ARMORY

UTAH NATIONAL GUARD
OGDEN, UTAH

DFCM Project No. 05040470

Harold P. Woodruff – Architect/Planner
223 East 800 South
Salt Lake City, Utah 84111
Phone: 801-355-8684

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at http://dfcm.utah.gov or are available upon request from DFCM:

DFCM General Conditions dated May 25, 2005
DFCM Application and Certificate for Payment dated May 25, 2005

Technical Specifications:
Drawings:

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at http://dfcm.utah.gov

INVITATION TO BID

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I AND HOLDING A GENERAL CONTRACTOR LICENSE ARE ALLOWED TO BID ON THIS PROJECT

The State of Utah - Division of Facilities Construction and Management (DFCM) is requesting bids for the construction of the following project:

ROOFING, MECHANICAL, ELECTRICAL, AND WINDOW IMPROVEMENTS
OGDEN ARMORY - UTAH NATIONAL GUARD – OGDEN, UTAH
DFCM PROJECT NO: 05040470

Replace existing BUR roof with new 60 mil TPO roof system, install new rooftop HVAC equipment, upgrade existing electrical system, and replace all windows in Armory with new. There will also be seismic improvements performed. Construction cost estimate: $400,000.00.

FIRM NAME	POINT OF CONTACT	PHONE	FAX
All Weather	Mr. Delmar Johnson	(801) 467-4270	(801) 467-3961
Capitol Roofing Service	Mr. Stewart B. Paulsen	(801) 562-5568	(801) 562-1159
Conwest, Inc	Mr. Phil Scarborough	(801) 553-0640	(815) 550-1136
Clark Quality Roofing	Mr. Perry Clark	(801) 266-3575	(801) 266-3692
Dave Atkinson Roofing, Inc.	Mr. Dave Atkinson	(435) 770-4299	(435) 258-2225
Heritage Roofing, LC	Mr. James Smith	(801) 576-8447	(801) 576-8311
Island Heights Construction, Inc	Mr. Terry Cronquist	(435) 753-7403	(435) 753-7452
Kendrick Brothers Roofing, Inc.	Mr. Brad L. Kendrick	(801) 731-2000	(801) 731-2020
Pitt Roofing & Construction, Inc.	Mr. Stacy Galley	(435) 789-6898	(435) 789-2802
Redd Roofing Company	Mr. K. Frank Redd	(801) 621-1363	(801) 621-1540
Summit Roofing & Waterproofing	Mr. Phil Whiting	(801) 529-2596	(801) 732-2186
Superior Roofing and Sheet Metal, Inc	Mr. Blake Redd	(801) 266-1473	(801) 266-1522
Utah Tile and Roofing, Inc	Mr. Paul Seppi	(801) 266-9694	(801) 266-6836

The bid documents will be available at 10:00 AM Tuesday, February 21, 2006 in electronic format from DFCM at 4110 State Office Building, Salt Lake City, Utah 84114, telephone (801)538-3018 and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Darrell Hunting, Project Manager, DFCM, at (801)538-9617. No others are to be contacted regarding this project.

A **MANDATORY** pre-bid meeting and site visit will be held at 1:30 P.M. on Wednesday, February 22, 2006 at the Ogden National Guard Armory, 625 East 5300 South, Ogden Utah. All short listed prime contractors wishing to bid on this project must attend this meeting.

Bids must be submitted by 3:30 PM on Wednesday, March 8, 2006 to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. Note: Bids must be received at 4110 State Office Building by the specified time. The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah. A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction & Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of the State.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
MARLA WORKMAN, CONTRACT COORDINATOR
4110 State Office Bldg., Salt Lake City, Utah 84114

STAGE II BIDDING PROCESS

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I ARE ALLOWED TO BID ON THIS PROJECT

1. Invitational Bid Procedures

Invitation to Bid: DFCM will notify each short-listed firm via e-mail and/or fax when a project is ready for construction services.

Bid Documents: Bidding documents including plans and specifications (if applicable) may be obtained by accessing DFCM's web page at http://dfcm.utah.gov or at DFCM's office 4110 State Office Building, Salt Lake City, Utah 84114.

Mandatory Pre-Bid Site Meeting: If required, the schedule contained in this document will indicate the date, time, and place of the mandatory pre-bid site meeting. At this meeting, contractors will receive additional instructions about the project and have an opportunity to ask questions about project details. If a firm fails to attend a pre-bid site meeting labeled "Mandatory" they will not be allowed to bid on the project.

Written Questions: The schedule contained in this document will indicate the deadline for submitting questions in writing to the DFCM Representative pertaining to this project.

Final Addendum: The schedule contained in this document will indicate the deadline for DFCM issuing the final addendum clarifying questions and changes to the scope of work. Contractors are responsible for obtaining and responding to information contained in the addenda.

Submitting Bids: Bids must be submitted to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114 by the deadline indicated on the schedule contained in this document. Bids submitted after the deadline will not be accepted. Bids will be opened at DFCM on the date, time, and place indicated on the schedule. (Additional information pertaining to bidding is contained later in this document). It is your responsibility to allow for the time needed to park on Capitol Hill as recent construction activity has made the parking more difficult. Identification is required to enter the building.

Subcontractors List: The firm selected for the project must submit a list of all subcontractors by the deadline indicated on the schedule contained in this document. (Additional information pertaining to subcontractor lists is contained later in this document)

2. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Notice to Contractors.

3. **Bids**

Before submitting a bid, each bidder shall carefully examine the Contract Documents; shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Notice to Contractor's prior to the published deadline for the submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.

If the bid bond security is submitted on a bid bond form other than the DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **Note: A cashier's check cannot be used as a substitute for a bid bond.**

4. **Contract and Bond**

The Contractor's Agreement will be in the form bound in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the Contract Sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for Subcontractors will be specified in the Supplementary General Conditions.

5. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractor's List Form", which are included as part of these Contract Documents. The subcontractors list shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contract for a period of up to three years.

6. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Representative a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by Addenda duly issued and a copy of such Addenda will be mailed or delivered to each person or entity receiving a set of documents. Neither DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

7. Addenda

Any Addenda issued during the time of bidding shall become part of the Contract Documents made available to the bidders for the preparation of the bid, shall be covered in the bid, and shall be made a part of the Contract.

8. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. The DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

9. **DFCM Contractor Performance Rating**

DFCM will evaluate the performance of the Contractor. This evaluation may include comments from the User. The Contractor will have an opportunity to review and comment on the evaluation. Evaluations, including the Contractor's comments, may be considered in future selection in the evaluation of the Contractor's past performance.

10. **Licensure**

The Contractor shall comply with and require all of its Subcontractors to comply with the license laws as required by the State of Utah.

11. **Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

12. **Time is of the Essence**

The completion deadline for this project is **Friday, August 18, 2006.** Failure to meet the completion deadline may result in a poor performance rating from DFCM which may have a negative impact on your firm's ability to obtain future work with the state of Utah and may also result in liquidated damages being assessed. Time is of the essence in regard to all the requirements of the Contract Documents.

13. **Withdrawal of Bids**

Bids may be withdrawn on written request received from bidders within 24 hours after the bid opening if the contractor has made an error in preparing the bid.

14. **Product Approvals**

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed

the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued Addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

15. **Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

Contractors shall respond promptly to any inquiry in writing by the DFCM to any concern of financial responsibility of the Contractor, Subcontractor or Sub-subcontractor.

16. **Debarment**.

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by the DFCM as part of the requirements for award of the Project.

PROJECT SCHEDULE
Stage II = Two-Stage Bidding Process

PROJECT NAME: ROOFING, MECHANICAL, ELECTRICAL, & WINDOW IMPROVEMENTS
OGDEN ARMORY - UTAH NATIONAL GUARD – OGDEN, UTAH
DFCM PROJECT # 05040470

Event	Day	Date	Time	Place
Stage II Bidding Documents Available	Tuesday	February 21, 2006	10:00 AM	DFCM, 4110 State Office Bldg, SLC, UT and DFCM web site *
Mandatory Pre-bid Site Meeting	Wednesday	February 22, 2006	1:30 PM	Ogden Natl Guard Armory 625 East 5300 South Ogden, UT
Last Day to Submit Questions	Wednesday	March 1, 2006	4:00 PM	Darrell Hunting Fax (801) 538-3267 Email – dhunting@utah.gov
Final Addendum Issued	Friday	March 3, 2006	4:00 PM	DFCM, 4110 State Office Bldg, SLC, UT or DFCM web site*
Prime Contractors Turn in Bid and Bid Bond / Bid Opening in DFCM Conference Room	Wednesday	March 8, 2006	3:30 PM	DFCM, 4110 State Office Bldg, SLC, UT
Subcontractors List Due	Thursday	March 9, 2006	3:30 PM	DFCM, 4110 State Office Bldg, SLC, UT
Project Completion Date	Friday	August 18, 2006		

*** DFCM's web site address is http://dfcm.utah.gov**

BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the Request for Bids for the **ROOFING, MECHANICAL, ELECTRICAL, AND WINDOW IMPROVEMENTS - OGDEN ARMORY - UTAH NATIONAL GUARD – OGDEN, UTAH – DFCM PROJECT NO. 05040470** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS ($_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **Friday, August 18, 2006**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$300.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within time set forth.

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

BID BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of $_____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the _____ _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____ .

Principal's name and address (if other than a corporation):

_____

_____

By: _____

Title: _____

Principal's name and address (if a corporation):

_____

_____

By: _____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.
My Commission Expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

INSTRUCTION AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

PROJECTS UNDER $500,000 - ALL SUBS $20,000 OR OVER MUST BE LISTED
PROJECTS $500,000 OR MORE - ALL SUBS $35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A.Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

(1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
(2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
(3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
(4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
(5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
(6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #
ELECTRICAL	ABCD Electric Inc.	$350,000.00	123456789000
LANDSCAPING	"Self"	300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: 350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCNTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.

SUBCONTRACTORS LIST
FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:
1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____ SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

FUGITIVE DUST PLAN

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

Utah Division of Air Quality
April 20, 1999

GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.

2. Address or location of your operation or construction site.

3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.

4. Lengths of the project, if temporary (time period).

5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.

6. Type of material processed or disturbed.

7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.

9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).

10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

Description of Fugitive Dust Emission Activities
(Things to consider in addressing fugitive dust control strategies.)

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).

2. List type of equipment generating the fugitive dust.

3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.

4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads "on" and "off" property.

5. Vehicle miles travels on unpaved roads associated with the activity (average speed).

6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)

7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

Description of Fugitive Dust Emission Controls on Site

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.

2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).

3. Method of application of dust suppressant.

4. Frequency of application of dust suppressant.

5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).

6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

Description of Fugitive Dust Control Off-site

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place "off" property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).

2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Fugitive Dust Control Plan Violation Report

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the course must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.

2. Time and duration of dust episode.

3. Meteorological conditions during the dust episode.

4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.

5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the sources dust control plan.

6. Reasons for failing to control dust from the dust generating activity or equipment.

7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.

8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Attachments: DFCM Form FDR R-307-309, Rule 307-309

CONTRACTOR'S AGREEMENT

FOR:

_____
_____
_____

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____ _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ _____ DOLLARS AND NO CENTS ($_____.00), which is the base bid, and which sum also includes the cost of a 100%

Performance Bond and a 100% Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete within _____ (___) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of $_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Notice to Contractors, Instructions to Bidders/Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the

Contractor requests payment and agrees to safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

_____
Signature Date

Title: _____

State of _____)
)
County of _____) _____
Please type/print name clearly

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

_____
Notary Public

(SEAL)

My Commission Expires _____

APPROVED AS TO AVAILABILITY OF FUNDS:

_____
Financial Manager, Date
Division of Facilities Construction and Management

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
_____ Date
Manager -
Capital _____

APPROVED AS TO FORM:
ATTORNEY GENERAL
May 25, 2005
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee, " in the amount of _____ _____ DOLLARS ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ _____ Dollars ($_____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20_____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____

(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)

) ss.

COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____ _____, a corporation organized and existing under the laws of the State of _____authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ _____ Dollars ($_____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, l953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____

(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____ _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

CHANGE ORDER #_____

CONTRACTOR:

ARCHITECT:

AGENCY OR INSTITUTION:
PROJECT NAME:
PROJECT NUMBER:
CONTRACT NUMBER:
DATE:

CONSTRUCTION CHANGE DIRECTIVE NO.	PROPOSAL REQUEST NO.	AMOUNT		DAYS	
		INCREASE	DECREASE	INCREASE	DECREASE

	Amount	Days	Date
ORIGINAL CONTRACT			
TOTAL PREVIOUS CHANGE ORDERS			
TOTAL THIS CHANGE ORDER			
ADJUSTED CONTRACT			

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor:_____
Date

Architect/Engineer:_____
Date

Agency or Institution:_____
Date

DFCM: _____
Date

Funding Verification:_____
Date

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

_____

_____

The Owner acknowledges receipt of the following closeout and transition materials:

☐ Record Drawings ☐ O & M Manuals ☐ Warranty Documents ☐ Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of_____. (Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ ____calendar days from the above date of issuance of this Certificate. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

_____ by: _____

CONTRACTOR (include name of firm) (Signature) DATE

_____ by: _____

A/E (include name of firm) (Signature) DATE

_____ by: _____

USING INSTITUTION OR AGENCY (Signature) DATE

_____ by: _____

DFCM (Owner) (Signature) DATE

4110 State Office Building, Salt Lake City, Utah 84114
telephone 801-538-3018 • facsimile 801-538-3267 • http://dfcm.utah.gov

cc: Parties Noted
DFCM, Director

STATE OF UTAH
UTAH NATIONAL GUARD
OGDEN ARMORY-ROOFING IMPROVEMENTS
DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT - PROJECT NUMBER 05040470
OGDEN, UTAH

TECHNICAL SPECIFICATIONS

STATE OF UTAH
UTAH NATIONAL GUARD
OGDEN ARMORY-ROOFING IMPROVEMENTS
DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT - PROJECT NUMBER 05040470
OGDEN, UTAH

SECTION 01010 - SUMMARY OF THE WORK

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. SUMMARY:

1. Project Description:
   Without force and effect on the requirements of the Contract Documents, the description of the work of the Contract is summarized as follows:

   Armory Original Building:
   a. Removal of existing roofing (to existing wood roof deck), flashing and coping.
   b. Installation of new plywood roof deck sheathing on existing T&G roof deck.
   c. Installation of new rigid insulation on roof deck and tapered insulation as shown on drawings.
   d. Installation of new FR-10 sheet on all new rigid insulation.
   e. Installation of new TPO roofing, flashing, coping and counter flashings.
   f. Installation of new mechanical equipment.
   g. Upgrade of electrical system and service to new mechanical equipment.
   h. Installation of new mechanical equipment screens.
   e. Disconnection of mechanical equipment (Mechanical and Electrical) and its reconnection after the curbs and supports have been modified.
   f. Remove and reinstall existing primary roof drains.
   g. Install new roof access ladders.
   i. Install new antenna base on upper and midlevel roofs and new antenna cable conduits with pull lines.
   j. Installation of new aluminum storefront windows.

C, SCOPE OF THE WORK:

1. The Contractor is responsible for the complete execution of the Contract Documents as indicated and specified.

   a. He is responsible for the work performed, the acts and omissions of his sub-contractors and suppliers and of persons either directly or indirectly employed by them, as well as the work, acts and omissions of persons directly employed by him.

2. Provide, without additional charge, all incidental items required to complete the work even though not specifically indicated.

   a. Install all work so that its several component parts function together as a workable system, and with all equipment properly adjusted and in working order.

3. Conform to the highest quality standards for materials and workmanship as required to execute work indicated, specified and necessary to fully satisfy the Contract requirements for a complete, finished and acceptable installation.

D. JOB CONDITIONS

1. The Contractor is responsible to verify all field measurements of actual site conditions so that all work fits properly in the locations indicated and specified.

2. Protect existing structures, improvements and landscaping from physical damage.

3. Upon completion of the project, dismantle and remove from the site all barricade materials.

4. Any existing improvements which are damaged by the Contractor are to be restored to their original or better condition to the satisfaction of the Owner.

E. SCHEDULING OF THE WORK

1. It is anticipated that work will be completed in the spring. Contractor may start the project at his option, however once the project has been started the contractor must diligently proceed with work on the project until it is completed. The project must be completed by May 31, 2004. The contractor may start work in the fall and/or winter if weather conditions permit. The contractor will be responsible for maintaining the roof in a watertight condition from the time starting with the Notice to Proceed thru the Substantial Completion.

    a. However, if cold or wet weather conditions delay the project, the Contractor may suspend the work through the winter provided that all areas of the roof are left watertight and not in a partially completed condition.
    b. Contractor assumes costs associated with such suspension and resumption of the work.
    k. Time remaining in the Contract at the time of suspension will be resumed at a mutually agreeable date in the spring.
    l. Contractor shall coordinate roof penetrations of a mechanical upgrade project with that contractor and temporarily tie into the existing built-up roof.

2. Time Delays due to Weather Conditions: Delays to re-roofing work on account of unfavorable weather conditions are excusable, but are not recompensable. Contract Time will be modified by Change Order according to the General Conditions, but without cost to the Owner, when the sole cause of the delay is weather conditions.

3. Owner Occupancy:

    a. Except for scheduled holidays and vacation periods, the facility will be occupied throughout the construction period.

4. Contractor shall cooperate fully with the User Agency and DFCM to coordinate appropriate sequencing of the work.

5. Disruption of Facility Operation Schedules: Contractor shall take reasonable precautions to limit

operations which would be disruptive to users and staff occupying the facility.

Prior to full Owner acceptance, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed.

F. HAZARDOUS MATERIALS:

1. It is considered unlikely the hazardous materials will be encountered in this project but if any hazardous materials are found or if the contractor suspects finding hazardous materials during his work. **STOP ALL WORK IMMEDIATELY!** The contractor shall call DFCM who in turn will contact the abatement consultants to come in and sample the materials for identification. **NO WORK SHOULD CONTINUE UNTIL THE ABATEMENT CONSULTANT HAS CERTIFIED THE AREA TO BE CLEAN OF HAZARDOUS MATERIALS.**

G. WORK UNDER OTHER CONTRACTS:

1. The Owner reserves the right to issue other contracts at appropriate times for items not specified as part of this work.

2, The Contractor is required to cooperate with the Owner and any other contractors assigned to portions of the work separately.

3. The Owner's own forces may perform certain portions of the work.

4. Other Contractors or Owner forces performing work on the project are not to be construed as employees or subcontractors, nor is the Contractor responsible for acts or omissions of those forces.

H. CONTRACTOR USE OF PREMISES

1. General:

   a. During the Construction Period, the Contractor will have use of designated portions of the Owner's property.
   b. Contractor assumes all liability for his operations within Owner's property.
   c. Erect warning/restriction signs, subject to review by the Owner, to alert non-construction personnel that the area is not for their use, and may not be entered.

2. Provide other directional signage where required by conditions which alter normal traffic and pedestrian paths.

3. Overhead Operations: When any overhead operations, such as crane work, extend over traffic or pedestrian routes, provide services of Certified Flaggers to control traffic in the area during period of time operations are in progress.

4. Covering of Loads: Refuse and debris transported from the site is to be covered or enclosed to prevent blowing of transported materials.

5. Contractor will be assigned a mutually agreeable area of the site for storage of a reasonable amount of materials.

    a. Refer to Temporary Facilities Section of additional requirements.

I. PERMIT FEES

1. No building permit fees are payable to local jurisdiction.

2. The Division of Facilities Construction and Management as an entity of the State of Utah is the Authority having jurisdiction for the project.

3. Refer to the General Conditions.

J. INTERRUPTION OF EXISTING UTILITIES:

1. Whenever the work of this contract requires the temporary shutdown of any existing utilities, file a Request for Shutdown with the Owner at least three (3) working days in advance and obtain written permission from the Owner before shutting off any existing utilities.

2. Minimize the interruption of existing utility services and systems which may affect the Owner's operations.

    a. When utility shutdowns would render facilities to be uninhabitable, schedule work for weekends or holidays as arranged with the User Agency.
    b. Provide alternate temporary utility services when utility shutdowns cannot be arranged otherwise to allow the Owner's continuing use of the facility.

K. CONSTRUCTION DOCUMENTS:

1. The Working Drawings which are listed in the Index to Drawings constitute the visual construction guide.

2. Working Drawings and Specifications are complimentary to each other and what is called for by one is as binding as if called for by both.

    a. In case of conflict between the two, prior to bidding and without Architect's clarification, assume that the most costly or stringent requirement will be incorporated into the work.
    b. Notify Architect for clarification or interpretation of conflicting requirements.
    c. Contractor is responsible to field verify all dimensions and quantities for existing conditions prior to bidding. Do not rely on scaled measurements from the Drawings.

3. In no case are manufacturer's or suppliers shop drawings to nullify, take precedence over, or supplant the Working Drawings.

4. Specification Divisions are divided into the standard sixteen construction industry major divisions with all work being categorized into one such division.

a. Individual elements of the work are subdivided into sections within each division.
b. Such assignment of the work is not intended to direct or limit the manner in which the General Contractor chooses to assign the work.
c. Schedule of Specification Divisions:
   Division 1 General Requirements
   Division 2 Site Work
   Division 3 Concrete
   Division 4 Masonry
   Division 5 Metals
   Division 6 Wood and Plastics
   Division 7 Thermal and Moisture Protection
   Division 8 Doors and Windows
   Division 9 Finishes
   Division 10 Specialties
   Division 11 Equipment
   Division 12 Furnishings
   Division 13 Special Construction
   Division 14 Conveying Systems
   Division 15 Mechanical
   Division 16 Electrical

5. Addenda, Change Orders, Supplemental Instructions, Construction Change Directives and Field Orders to modify, interpret other documents, or otherwise alter the scope of the project become part of the Contract Documents, whether or not included within the Project Manual.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION

STATE OF UTAH
UTAH NATIONAL GUARD
OGDEN ARMORY-ROOFING IMPROVEMENTS
DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT - PROJECT NUMBER 05040470
OGDEN, UTAH

SECTION 01035 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. SUMMARY:

1. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

C. PROCEDURES FOR CHANGES IN SCOPE OF WORK

1. Minor Changes in the Work

   a. Supplemental Instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued as Architect's Supplemental Instructions.

2. Change Order Proposal Requests

   a. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
   b. Proposal Requests issued by the Architect are for information only.
      (1) Do not consider them as instruction either to stop work in progress, or to execute the proposed change.
      (2) Unless otherwise indicated in the proposal request, within 3 working days of receipt of the proposal request, submit to the Architect for the Owner's review an itemization of cost necessary to execute the proposed change.
      (3) Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
      (4) Indicate quantities of direct labor with rates, applicable taxes, equipment rentals, delivery charges and similar expenses.
      (5) Identify cost of overhead and profit as indicated by General Conditions.
      (6) Include a statement indicating the effect the Proposed Change in the work will have on the Contract time.
   c. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
      (1) Include a statement outlining reasons for the change and the effect of the change on the Work.
      (2) Include a list of quantities of products to be purchased and unit costs along with the total

amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

(3) Indicate quantities of direct labor with rates, applicable taxes, equipment rentals, delivery charges and similar expenses.

(4) Identify cost of overhead and profit as indicated by the General Conditions.

(5) Include a statement indicating the effect the Proposed Changes in the work will have on the Contract Time.

d. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive, instructing the Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order.

(1) The Construction Change Directive will contain a complete description of the change in the work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

(2) The Owner retains the right to unilaterally determine the costs attributable to the applicable event or situation, plus appropriate profit or fee, subject to the Contractor's legal and contractual remedies.

(3) Documentation: Maintain detailed records on a time and material basis for work required by the Construction Change Directive.

(4) After completion of the Change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

3. CHANGE ORDER PROCEDURES

a. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and Contractor, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS

No Requirements.

PART 3 - EXECUTION

No Requirements.

END OF SECTION

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SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL:

A. Definition: "Cutting and Patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition.

B. Refer to other sections of these specifications for specific cutting and patching requirements and limitations applicable to individual units of work.

C. Structural Work: Do not cut-and-patch structural work in a manner resulting in a reduction of load-carrying capacity or load-deflection ratio. Submit proposal and request and obtain Architect's approval before proceeding with cut-and-patch of structural work.

D. Operational/Safety Limitations: Do not cut-and-patch operational elements and safety components in a manner resulting in decreased performance, shortened useful life, or increased maintenance. Submit proposals and requests and obtain Architect's approvals before proceeding with cut-and-patches.

E. Visual/Quality Limitations: Do not cut-and-patch work exposed to view (exterior and interior) in a manner resulting in noticeable reduction of aesthetic qualities and similar qualities, as judged by Architect.

F. Limitation on Approvals: Architect's approval to proceed with cutting and patching does not waive right to later require removal/replacement of work found to be cut-and-patched in an unsatisfactory manner, as judged by Architect.

PART 2 - PRODUCTS:

A. General:

1. Use materials for cutting and patching that are identical to existing materials. If identical materials are not available, or cannot be used, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect.

2. Use materials and methods for cutting and patching that will result in equal-or-better performance characteristics as judged by the Architect.

PART 3 - EXECUTION:

A. Inspection: Before cutting, examine surfaces to be cut and patched and conditions under which the work is to be performed.

1. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the work.

B. Temporary Support: To prevent failure provide temporary support of work to be cut.

C. Protection:

1. Protect other work during cutting and patching to prevent damage.

2. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations.

3. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

4. Take precautions not to cut existing pipe, conduit or duct serving the building but scheduled to be relocated until provisions have been made to bypass them.

D. Cutting:

1. Cut the work using methods that are least likely to damage work to be retained or adjoining work.

2. Where possible review proposed procedures with the original installer; comply with original installer's recommendations.

3. Where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping.

    a. Cut through concrete and masonry using a cutting machine such as a carborundum saw or core drill.
    b. Cut holes and slots neatly to size required with minimum disturbance of adjacent work.

        (a) To avoid marring existing finished surfaces, cut and drill from the exposed or finished side into concealed surfaces.

4. Temporarily cover openings when not in use.

E. Patching:

1. Patch with seams which are durable and as invisible as possible.

2. Comply with specified tolerances for the work.

    a. Restore exposed finished of patched areas and where necessary extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and refinishing.

END OF SECTION

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SECTION 01090 - DEFINITIONS AND STANDARDS

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. DEFINITIONS:

1. General: Except as specifically defined otherwise, the following definitions supplement definitions of the Contract, General Conditions, Supplementary Conditions and other general contract documents, and apply generally to the work.

2. General Requirements: The provisions of Division-1 sections, General Requirements, apply to the entire work of the Contract.

3. Indicated: Shown on drawing by notes, graphics or schedules, or written into other portions of contract documents.

   a. Terms such as "shown", "noted", "schedules", and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.

4. Directed, Requested, Approved, Accepted, Required etc.: These terms imply "by the Architect", unless otherwise indicated.

5. Approved by Architect: In no case releases Contractor from responsibility to fulfill requirements of Contract Documents.

6. Project Site: Space available to Contractor at location of project, either exclusively or to be shared with separate contractors, for performance of work.

7. Furnish: Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar subsequent requirements.

8. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.

9. Provide: Furnish and install, complete and ready for intended use.

10. Installer: Entity (firm or person) shall be engaged to install work, by Contractor, subcontractor or sub-subcontractor.

    a. Installers shall be skilled in work they are engaged to install.

11. Specification Text Format: Underscoring facilitates scan reading, no other meaning.

a. Imperative language is directed at Contractor, unless otherwise noted.

12. Overlapping/Conflicting Requirements:

    a. Most stringent or costly requirement written directly into the contract documents is intended and will be enforced. Any modifications prior to bidding will be addressed by Addendum.
    b. Refer uncertainties to the Architect for a decision before proceeding.
    c. Where optional requirements are specified in a parallel manner, option is intended to be Contractor's unless otherwise indicated.

13. Minimum Quality Requirements:

    a. Indicated requirements are for a specific minimum acceptable level of quality/quantity, as recognized in the industry.
    b. Actual work must comply (within specified tolerances), or may exceed minimums within reasonable limits.
    c. Refer uncertainties to Architect before proceeding.

14. Abbreviations, Plural Words:

    a. Abbreviations, where not defined in contract documents, will be interpreted by the Architect to mean the normal construction industry terminology, determined by recognized grammatical rules.
    b. Plural words will be interpreted as singular and singular words will be interpreted as plural where applicable for context of contract of documents.

15. Testing laboratory: An independent entity engaged for the project to provide inspections, tests, interpretations, reports and similar services to verify conformance with Contract Documents.

C. STANDARDS AND REGULATIONS:

1. Industry Standards:

    a. Applicable standards of construction industry have same force and effect on performance of the work as if copied directly into contract documents or bound and published therewith.
    b. Standards referenced in contract documents or in governing regulations have precedence over non-referenced standards, insofar as different standards may contain overlapping or conflicting requirements.
    c. Comply with standards in effect as of date of contract documents, unless otherwise indicated.

2. Abbreviations:

    a. Where abbreviations or acronyms are used in contract documents, they mean the well recognized name of entity in building construction industry.
    b. Refer uncertainties to Architect before proceeding, or consult "Encyclopedia of Associations" by Gale Research Co.

PART 2 - PRODUCTS

No Requirements.

PART 3 - EXECUTION

No Requirements.

END OF SECTION

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SECTION 01205 - PROCEDURES AND CONTROLS

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. ADMINISTRATION AND SUPERVISION:

1. Coordination: Coordinate various elements of the work and entities engaged to perform work; and coordinate the work with existing facilities/conditions, and with work by separate contractors (if any) and by Owner.

C. INSPECTION AND TESTING:

1. General:

   a. Provide required inspection and testing services specified to be by independent agencies, where not indicated specifically as Owner's responsibility (this provision supplements General Conditions).
2. Neither inspection-and-test results nor failure thereof to disclose deficiencies relieves Contractor of responsibility to comply with requirements of contract documents.

   a. Provide services to inspection and testing agencies (Owner's and Contractor's), including taking and delivery of samples, patching work and similar assistance.
   b. Require engaged agencies to perform indicated testing and submit reports promptly; and to report significant observations having an important bearing on the work, to the Architect/Engineer by the most expeditious means possible.

3. Installer Inspections:

   a. Require Installer of each major unit of work to inspect substrate and conditions for installation, and to report (in writing) unsatisfactory conditions.
   b. Correct unsatisfactory conditions before proceeding.
   c. Inspect each product immediately before installation, and do not install damaged or defective products, materials or equipment.

D. PREPARATION FOR INSTALLATION:

1. Pre-Installation Conference:

   a. Prior to starting installation of each major component of the work, hold a pre-installation conference, attended by each entity involved or affected by planned installation.
   b. Include technical representatives of product manufacturers and others recognized as expert or otherwise capable of influencing success of the installation.
   c. Review significant aspects of requirements for the work.

d. Record discussion and distribute as plan of action.
e. Pre-installation conferences are specifically required for (but not limited to) the following installations:
   (1) Roofing system.
   (2) Sheet metal work.
   (3) Structural work.
   (4) Mechanical work.
   (5) Electrical work.

E. INSTALLATION, GENERAL:

1. Comply with manufacturer's instructions and recommendations to extent printed information is more detailed or stringent than requirements contained directly in contract documents.

2. Timing: Install work during time and under conditions which will ensure best possible results, coordinated with required inspection and testing.

3. Anchor work securely in place, properly located by measured line and level, organized for best possible uniformity, visual effect, operations efficiency, durability, and similar benefit to Owner's use.

4. Isolate non-compatible materials from contact, sufficiently to prevent deterioration.

5. Mount individual units of work at industry-recognized mounting heights, if not otherwise indicated.

   a. Refer uncertainties to Architect before proceeding.

F. CLEANING AND PROTECTION:

1. General:

   a. Clean each element of work at time of installation.
   b. Provide sufficient maintenance and protection during construction to ensure freedom from damage and deterioration at time of substantial completion.

PART 2 - PRODUCTS

No Requirements.

PART 3 - EXECUTION

A. Provisions of this Section are applicable as General Requirements to all other Sections of the work.

END OF SECTION

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SECTION 01310 - SCHEDULES, REPORTS, PAYMENTS

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. PROGRESS SCHEDULE AND REPORTS:

1. General: Prepare a fully developed, bar graph construction schedule which identifies the relationships of sequencing of all significant elements of the work as listed in the required "Schedule of Values".

2. Submit schedule to Architect/Owner within 15 calendar days of the receipt of Notice Proceed.

    a. Contractors first payment application must be accompanied by the completed schedule, if not submitted previously.

3. Coordinate the Contractor's construction schedule with the Schedule of Values, submittal schedule, progress reports, payment requests, and other time related schedules and factors.

4. Indicate completion in advance of the date established for Substantial Completion.

    a. Allow time for completion of Project Closeout procedures identified in another Division 1 Section, including preparation of operation and maintenance manuals, completion of record documentation (as-builts), in order for Architect to certify Substantial Completion.

5. Cost Correlation: Coordinate dollar-volume of the work performed as the basis of identifying actual progress of construction as of the dates used for preparation of payment requests.

6. Revisions to the Schedule: Use the schedule as the basis to justify time extension requests associated with Changes in the scope work as authorized by Change Orders.

7. Climate and Weather Considerations: Prepare schedule to account for normal seasonal weather and climatic conditions in planning temperature and moisture sensitive elements of the work.

8. Distribution: Following Architect/Owner's response to the initial submittal of the schedule, print and distribute copies to the Architect, Owner, subcontractors, suppliers, and others required to comply with the scheduled dates.

9. When revisions are made, re-distribute to the same parties.

10. Schedule Updating:

    a. Revise the schedule at least monthly to reflect current states of construction progress.
    b. Issue the updated schedule at time payment requests are submitted each month. Payment

Requests will not be forwarded to the Owner without the required updated schedule.

C. MEETINGS AND REPORTING:

1. Contractor Project Meetings:

   a. Conduct general progress and coordination meetings at least once each week, attended by a representative of the General Contractor and the Owner's representative.
   b. Record discussions and decisions, and distribute copies to those attending and others affected including Architect and Owner's representative.
   c. Schedule meetings to coordinate with preparation of payment requests.

2. Construction Meetings: Attend periodic coordination meeting to be conducted by Contractor and attended by Architect/Engineer, Owners Representative and others as determined by progress of Work.

D. SCHEDULES OF VALUES:

1. Prepare a schedule of values to show breakdown of Contract Sum corresponding with payment request breakdown and progress schedule line items.

2. Show dollar value and percent of total for each unit of work scheduled.

3. Revise each time schedule is affected by change order or other value revision.

E. PAYMENT REQUESTS:

1. Submit request for each calendar month, not later than the 15th day of the following month.

2. Use AIA form G702 or equivalent format, fully completed and executed.

   a. Submit the forms in triplicate, including attachment of waivers and similar documentation with one copy.

3. Prior to the initial payment request, submit:

   a. List of principal subcontractors and suppliers.
   b. Progress schedule and first progress report.
   c. Following issuance by Architect of Certificate of Substantial Completion, Contractor may submit special payment request, provided the following have been completed:
      (1) Obtain permits, and other approval and releases by governing authorities, required for Owner's occupancy and use of the project.
      (2) Submit warranties and similar documentation.
      (3) Submit maintenance manuals and provide instruction of Owner's operational/maintenance personnel.
      (4) Complete final cleaning of the work.
      (5) Submit record documents.

4. Following completion of the following requirements, final payment request may be submitted:

    a. Complete work listed as incomplete at time of substantial completion.
    b. Transfer operational, access, security and similar provisions to Owner; and remove temporary facilities, tools and similar items.
    c. Completion of requirements specified in "Project Closeout" section.
    d. Obtain consent of surety for final payment.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

Not applicable

END OF SECTION

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SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. GENERAL DEFINITIONS:

1. Work-Related Submittals:

   a. The provisions of this section apply to those required submittals that are related to individual units of work, not to administrative submittals, such as payment requests, insurance certificates and progress reports.
   b. In addition to specific provisions of the General and Supplementary Conditions regarding work-related submittals, specification sections in Divisions 2 through 16 contain submittal requirements.
   c. Specific requirements in other specification sections have precedence over the general requirements contained in this section.

2. Miscellaneous Submittals:

   a. In addition to the specific categories of shop drawings, product data and samples, as defined in the General Conditions, a category of miscellaneous submittals is required. This category includes, but is not limited to the following:
      (1) Warranties.
      (2) Workmanship Bonds.
      (3) Maintenance Manuals.
      (4) Inspection and Test Reports.
      (5) Closeout Submittals.

C. PROCEDURAL REQUIREMENTS:

1. Coordination:

   a. Coordinate the preparation and processing of work-related submittals with the performance of the work.
   b. Coordinate each separate submittal with other submittals and related activities that require sequential activity.
   c. Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the necessity of reviewing a related submittal.
   d. Prepare and transmit each submittal sufficiently in advance of the schedule performance of related work and similar activities.

2. Review Time:

a. Allow 2 weeks for the Architect's initial processing of each submittal.
b. Allow one week for reprocessing each re-submittal.
c. No extension of time will be authorized because of failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

3. Submittal Preparation:

a. Mark each submittal with a permanent label for identification.
b. Provide project name, date, name of Architect, name of Contractor, number and title of appropriate specification section and similar definitive information.
c. Provide a space on submittal for Contractor's and Architect's review markings.

4. Additional Copies: Provide additional copies of submittals required by governing authorities that are in addition to copies specified for submittal to the Architect.

D. SPECIFIC SUBMITTAL REQUIREMENTS:

1. General: Where it is necessary to provide intermediate submittals between the initial and final submittals, provide and process intermediate submittals in the same manner as for initial submittals.

2. Shop Drawings:

a. Submit newly prepared information drawn to accurate scale.
b. Highlight, encircle, or otherwise indicate deviations from Contract Documents.
c. Do not reproduce Contract Documents as the basis of Shop Drawings.
d. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

3. Include fabrication and installation drawings setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:

a. Dimensions.
b. Identification of products and materials included.
c. Notations of Coordination requirements.
d. Notation of dimensions established by field measurement.
e. Compliance with specified standards.

4. Copies:

a. Architect will retain one or two copies of information submitted.
b. Submit additional copies as required for distribution by Contractor to subcontractors and suppliers.

5. Re-submittals: Comply with same requirements as for initial submittal.

6. Product Data:

a. Where Manufacturer's published product data is provided for submittal review, mark each copy to indicate the actual product to be supplied.
b. Show selections from among options in the manufacturer's printed product data
c. Submit 4 copies to Architect; submittal is for information and record purposes only.
d. Where the product data is required for maintenance manuals, make additional copies from approved submittals.
e. Do not proceed with the installation of manufactured products until a copy of related product data is in the installer's possession at the project site.

7. Samples:

a. Submit 3 sets of samples; 2 sets will be returned.
b. Provide 3 or more samples in each set where variations in color, pattern or texture are observable; show average conditions and extreme range of variations.
c. Submit full documentation with each set.
d. Samples submittals are for Architect/Engineer's observations of color, texture, pattern and "kind".
e. Maintain one returned set at project site in Field Office with other submittal items for purposes of quality control comparisons.

8. Miscellaneous Submittals: Provide copies of miscellaneous submittals as follows:

a. Warranties: Submit 1 executed original, plus additional copies as required for maintenance manuals.
b. Inspection and Test Reports: Where not processed as shop drawings or product data, provide 1 copy, plus additional copies as required for maintenance manuals.
c. Record Drawings: Submit original maintained mark-up prints.

E. ARCHITECT/ENGINEER'S ACTION:

1. Stamp: The Architect/Engineer will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked and executed to indicate the status of the submittal.

PART 2 - PRODUCTS

No Requirements.

PART 3 - EXECUTION

No Requirements.

END OF SECTION

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SECTION 01505 -TEMPORARY FACILITIES

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. GENERAL DEFINITIONS:

1. Work-Related Submittals:

   a. This section specifies certain minimum temporary facilities to be provided, regardless of methods and means selected for performance of the work, but not by way of limitation and not assured for compliance with governing regulations.
   b. Use of alternate temporary facilities is Contractor's option, subject to Architect's acceptance.
   c. Temporary facilities is defined to exclude tools and construction machines, testing, demolition, alterations, soil boring, mock-ups and similar items.

2. Energy Considerations: Administer the use of temporary facilities in a manner which conserves energy, but without delaying work or endangering persons or property; comply with reasonable requests by Owner and Architect.

3. Costs: Except as otherwise indicated, costs associated with temporary facilities are Contractor's (in Contract Sum), Temporary facilities remain property of Contractor.

4. Sources:

   a. Water: Connect as needed to Owner's existing water system.
      1. Reasonable water usage will be paid by the Owner.
   b. Power: Connect to Owner's existing system.
   c. Owner will pay for incidental power usage.
   d. Do not connect temporary electric heating devices or welding equipment or other high demand electric equipment to Owners power system.
   e. For welding and electric heating, provide mobile generator units as required.

C. TEMPORARY CONSTRUCTION FACILITIES:

1. Hoisting, General: Provide cranes, and/or hoists as needed to adequately perform the work

D. TEMPORARY SUPPORT FACILITIES:

1. General: Provide facilities and services as may be needed to properly support primary construction process and meet governing regulations.

2. Field Offices: No field office will be required provided that arrangements are made to keep complete sets of Construction Drawings, Project Manual, copies of approved Shop Drawings and

other submittals, and similar reference materials available at the site.

3. Drinking Water: Readily available at the site at all times when work is in progress.

4. Toilets: Provide single-occupant, self-contained units; glass fiber reinforced polyester enclosure; equipped with both urinal and stool fixtures. Supply units with tissue and wet-type hand towels and waste containers.

    a. Construction personnel will not be permitted to use permanent toilet facilities in the building.

5. Telephones: Arrange acceptable communications means approved by the Architect.

PART 2 - PRODUCTS

No Requirements.

PART 3 - EXECUTION

No Requirements.

END OF SECTION

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SECTION 01610 - PRODUCTS AND SUBSTITUTIONS

A. PROCEDURAL REQUIREMENTS:

1. General Limitations:

    a. Where possible, provide entire required quantity of each generic product, material or equipment from a single source; and, where not possible to do so, match separate procurements as closely as possible.
    b. To extent selection process is under Contractor's control, provide compatible products, material and equipment.
    c. Where available and complying with requirements, provide standard products which have been used previously and successfully in similar applications, and which are recommended by manufacturers for applications indicated.

B. PRODUCT SELECTION LIMITATIONS:

1. Product Selections: Comply with the following for selection of products, materials and equipment.

    a. Single Product Named: Provide only that product, unless determined to be unavailable, non-compatible with the work, or non-complying with requirements or governing regulations.
    b. Two or More Products Named: Selection from named products is Contractor's option, provided selection complies with requirements.
    c. "Or-Equal" Clause: Provide named product which complies with requirements, or comply with requirements for gaining approval on "substitution" to select and use an unnamed product.

2. Compliance with Standards: Selection of product which complies with requirements, including applicable standards, is Contractor's option where no product names are indicated.

3. Performance Requirements: Selection of product which has been tested to show compliance with requirements, including indicated performances, is Contractor's option where no product names are indicated.

4. Prescriptive Requirements: Selection of product which has been certified by manufacturer to comply with requirements, including prescriptive requirements, is Contractor's option where no product names are indicated.

5. Visual Requirements:

    a. Where indicated to be selected from manufacturer's standard options, selection is Architect's, subsequent to determination or selection of manufacturer (Contractor's option).
    b. Where indicated to be selected from among standard options available within industry, selection is Architect's option prior to determination or selection of manufacturer.

6. Nameplates:

    a. Where indicated or needed for operation and maintenance, provide permanent nameplates

on equipment, located in inconspicuous but accessible places, and containing suitable information and operational data.

b. Otherwise, do not allow manufacturer's trademarks or similar labels or nameplates to be placed on products in locations where exposed to view after installation.

C. SUBSTITUTIONS:

1. Conditions: Requests for substitutions by Contractor will be considered when reasonable, timely, fully documented and qualifying under one or more of the following circumstances:

   a. Related to an "or equal" or similar provision in contract documents prior to the bidding.
   b. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disability as certified by Contractor.

2. Submittals: Include full documentation, including product data, samples where appropriate, detailed performance comparisons and evaluation, testing laboratory reports where applicable, coordination information for effect on other work and time schedule, cost information for proposed change order, Contractor’s general certification of recommended substitution, and similar information germane to circumstance.

3. Materials/Manufacturers Selected by Pre-Qualification: Where specific products have been selected previous to the bidding by separate pre-qualification procedures, no substitutions will be considered.

D. DELIVERY, STORAGE AND HANDLING:

1. General:

   a. Receive, store and handle products, materials and equipment in a manner which will prevent loss, deterioration and damage.
   b. Schedule deliveries to minimize long-term storage at project site.

E. WARRANTIES (GUARANTEES):

1. Categories of warranties required for the work include:

   a. Special project warranty issued by Contractor and, where required, countersigned by Installer or other recognized entity involved in performance of the work.
   b. Specified product warranty issued by a manufacturer or fabricator, for compliance with requirements in contract documents.
   c. Coincidental product warranty available on a product incorporated into the work, by virtue of manufacturer's publication of warranty without regard for application requirements (non-specified warranty).

2. Refer to sections of Divisions 2 through 16 for requirements of specified warranties.

3. Warranty Obligations:

a. Restore or remove-and-replace warranted work to its originally specified condition, at such time during warranty as it does not comply with or fulfill terms of warranty.
b. Restore or remove-and-replace other work which has been damaged by failure of warranted work, or which must be removed and replaced to gain access to warranted work.
c. Except as otherwise indicated or required by governing regulations, warranties do not cover consequential damages to property other than work of the Contract.

4. Reinstatement of Warranty: Upon restoration or removal-and-replacement of warranted work which has failed, reinstate the warranty by issuing newly executed form, for at least the remaining period of time of the original warranty.

5. Owner's Recourse:

a. Warranties and warranty periods do not diminish implied warranties, and do not deprive Owner of actions, rights and remedies otherwise available for Contractor's failure to fulfill requirements of the contract documents.
b. Owner reserves right to reject coincidental product warranties considered to be conflicting with or detracting from requirements of the contract documents.

END OF SECTION

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SECTION 01700 - PROJECT CLOSEOUT

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. DESCRIPTION OF REQUIREMENTS:

1. Provisions of this section apply to the procedural requirements for the actual closeout of the Work, not to administrative matters such as final payment or the changeover of insurance. Closeout requirements relate to both substantial and final completion of the Work; they also apply to individual portions of completed work as well as the total Work.

2. Specific requirements contained in other sections have precedence over the general requirements contained in this section.

C. PROCEDURES AT SUBSTANTIAL COMPLETION:

1. Prerequisites: Comply with the General Conditions and complete the following before requesting the Architect/Engineer's inspection of the Work, for certification of Substantial Completion.

   a. Dates of all documentation must correspond to Substantial Completion Date.
   b. Submit record documentation, tools, spare parts, keys and similar operational items.
   c. Complete final cleaning, and remove temporary facilities and tools.

2. Submittals for Operation and Maintenance Manuals: Submit two (2) sets each of the following categories of materials to the Architect as a prerequisite for Substantial Completion of the project. Prepare all submittal items to fit format of standard three ring binders.

   a. Executed warranties (1 Original).
   b. Copy of all approved product submittals.

3. Inspection Procedures:

   a. Upon completion of the project, including checking of mechanical and electrical systems, submittal of Operation and Maintenance Manuals, Contractor shall prepare a punchlist indicating all incomplete work and deliver copies of it to the Architect. If approved, the Architect will schedule a pre-final inspection.
   b. Pre-final Inspection: The following persons will attend the pre-final inspection:
      (1) Architect and Consultants
      (2) General Contractor and Subcontractors including:
         (a) Roofing Contractor
         (b) Sheet Metal Contractor
         (c) Mechanical/Plumbing Subcontractor
      (3) Architect will compile a Pre-Final Punchlist which will be distributed to the Owner and

Contractor.

c. Substantial Completion Inspection: Upon completion, or substantial completion, of the work listed on the Pre-final Punchlist, notify the Architect in writing that the project is ready for inspection, at which time an inspection will be scheduled to include the following persons:
   (1) Architect and Consultants
   (2) Owners Representatives
   (3) Contractor and subcontractors including:
      (a) Roofing Contractor
      (b) Sheetmetal Contractor
      (c) Plumbing/Mechanical Subcontractor(s).

If the work is sufficiently completed, a Certificate of Substantial Completion will be prepared bearing this date to which a punchlist of any of items of incomplete work will be attached. A time limit will be arranged which is mutually agreeable to the Owner, Contractor and Architect during which time the Punchlist Work must be completed.

d. Final Acceptance Inspection Procedure:

   (1) The Architect will reinspect the Work upon receipt of the Contractor's written notice that the Work has been completed, including punch-list items from earlier inspections.
   (2) Upon completion of reinspection, the Architect will either recommend final acceptance and final payment, or will advise the Contractor of work not completed or obligations not fulfilled as required for final acceptance.
   (3) If necessary, this procedure will be repeated, with the Contractor responsible for payment of Architect's expenses for each such additional inspection payable in advance directly to the Architect at the published hourly rates for the Architect and including any other direct costs for the work.
   (4) If punchlist work is not completed within the prior agreed upon time period at Substantial Completion, the Owner may exercise the option to remove the Contractor from eligibility as a Pre-Qualified Contractor to bid on other projects for the State of Utah, upon ten (10) days written notice from the Owner.

D. RECORD DOCUMENTATION:

1. Record Drawings:

   a. Maintain a complete set of either blue- or black-line prints of the Contract Drawings and Shop Drawings for record mark-up purposes throughout the Contract Time.
   b. Mark-up these drawings during the course of the work to show both changes and the actual installation, in sufficient detail to form a complete record for the Owner's purposes.
   c. Give particular attention to work which will be concealed and difficult to measure and record at a later date, and work which may require servicing or replacement during the life of the project.
   d. Require the entities marking prints to sign and date each mark-up.
   e. Bind prints into manageable sets, with durable paper covers, appropriately labeled.

E. GENERAL CLOSEOUT REQUIREMENTS:

1. Final Cleaning:

    a. At the time of project closeout, clean or reclean the Work to the condition expected from a normal, commercial building cleaning and maintenance program.
    b. Complete the following cleaning operations before requesting the Architect/Engineer's inspection for certification of Substantial Completion.
        (1) Clean exposed finishes, interior and exterior affected by this work.
        (2) Touch-up minor finish damage.
        (3) Remove debris.
        (4) Sweep and wash paved areas involved in construction.
        (5) Police yards and grounds of construction debris.

PART 2 - PRODUCTS

No Requirements.

PART 3 - EXECUTION

No Requirements.

END OF SECTION

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SECTION 02070 - SELECTIVE DEMOLITION

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 General Requirements Sections, apply to work of this Section.

B. SUMMARY:

1. This Section includes the following scope of work:

   a. Furnish labor, equipment, and materials as required to complete the demolition work as indicated on the drawings and by provisions of this Section, including:
   b. Remove and haul away existing built-up roofing membrane, gravel stops, and flashings.
   c. Legally dispose of roofing membrane and flashings.

C. SUBMITTALS:

1. Submit a written notification to the Architect of methods intended for removal and disposal of existing roofing materials prior to commencement of the work.

2. Disposal Site: Provide written evidence that the selected disposal site is approved to receive the Category of materials being disposed. For hazardous materials disposal, submit copies of certification authorization or licensure of site by governing authorities.

3. Certification of Disposal: Submit copies of Asbestos Manifest to the Owner, User Agency, and Disposal Site for each load of waste which contains asbestos material. (No asbestos has been identified on the roof).

D. QUALITY ASSURANCE

1. Comply with the following governing authorities having jurisdiction for type of demolition/roof removal work required.

   a. U.S. Environmental Protection Agency (EPA).
   b. Occupational Safety and Health Administration (OSHA).
   c. Utah State Health Department Division of Air Quality.
   d. State and Local regulations pertaining to removal, transportation (including covering of loads) and disposal for type of material.

PART 2 - PRODUCTS

A. No Requirements

PART 3 - EXECUTION

A. GENERAL:

1. Become familiar with local laws and regulations governing the work of this section at the time work is performed.

    a. Perform work in strict accordance with local, state and federal laws and regulations.

2. Protect and maintain walls, windows, doors, lawns, vegetation, sidewalks, driveways, conduits, wires, and all other related structures and fixtures in, on, around or adjacent to the project site that are to remain on or adjacent to the property.

    a. Use debris chutes, canvas tarps, single ply membranes, plywood, etc. as needed or required to provide protection.

3. Execute work in an orderly and careful manner.

    a. Remove all materials, rubbish, and debris from the roof, and thoroughly clean up the roof and grounds and haul away each day.
    b. Completely remove and thoroughly clean all dirt, dust and stains resulting from the demolition from building interior, building exterior, grounds, adjacent property, etc.

4. Thoroughly clean all asphalt and plastic cement off of pipes, walls, ducts, and any other improvements.

5. All materials which are not otherwise indicated for reinstallation or to be salvaged by the Owner become the property of the Contractor and are to be removed immediately from the site.

    a. Sale of salvaged materials at the site is prohibited.

B. ASBESTOS REMOVAL (no asbestos has been identified on this roof):

1. Work includes removal and disposal of all asbestos containing roofing materials.

2. Work under this section shall be performed by, or under the direction of the Contractor providing work under Section 07530 – Single Ply Membrane Roofing System.

3. Perform removal work without damage or contamination of adjacent work.

    a. Where such work is damaged or contaminated, restore it to its original condition.

4. Asbestos containing roofing materials may be removed in conjunction with re-roofing tear-off procedures.

    a. However, all asbestos materials must be separated and disposed of independently of other tear-off materials.
    b. Provide a separate staging area for disposal of asbestos containing materials.

5. Removed asbestos containing materials are to be carefully lowered into a truck by means of a

dust tight container using a hoist.

a. Do not drop or throw asbestos containing materials into trucks.

6. Notify approved landfill site at least 48 hours in advance of each delivery, and shall verify and conform to requirements of specific landfill site regarding delivery of asbestos containing materials.

   a. Distribute completed copies of **Asbestos Manifest** for each delivery to disposal site. Asbestos Manifest form is included in Procedural Documents.
   b. Dispose of asbestos containing materials on a regular basis at an approved landfill site.
   c. Trucks used to dispose of materials must be covered at all times during transit.

7. Temporarily cover and seal existing mechanical units, ventilators, curbs, etc. and shut down or extend air-intakes so that no dust, dirt, or debris enters the building, attic, skylight wells, ductwork, etc.

8. Temporarily seal openings in deck at roof drains, pipes, conduits, ductwork, stacks, perimeters, etc. prior to removal of asbestos containing materials.

9. Vacuum or power sweep existing roof surfaces to remove dirt and loose aggregate prior to cutting or removing the membrane flashings.

10. Dampen roof surface prior to cutting to control dust.

    a. Kept materials damp until deposited and covered in truck or dumpster.

11. Manually cut and remove existing non-friable asbestos containing materials from existing surfaces without sawing, sanding, drilling, grinding or pulverizing.

    a. Toothed Power cutters, spudders, grinders, saws, etc. which create airborne particulate shall not be used on asbestos containing materials.

12. Meet or exceed OSHA & EPA requirements for containment of asbestos containing materials

C. EXISTING ROOFTOP MECHANICAL EQUIPMENT

1. Remove and reset roof top air vents, mechanical units, and similar elements as indicated on drawings.

2. All electrical, plumbing and mechanical work shall be performed by licensed subcontractors only.

3. Repair any damage resulting from removal and reinstallation work.

4. Make openings in roof watertight while equipment is removed during construction.

5. For occupied buildings, keep equipment functioning during construction to greatest extent possible.

a. Where required by Construction Documents, provide temporary equipment and means to maintain building systems in operable condition for occupancy by users.

D. REMOVAL OF EXISTING BUILT-UP ROOFING

1. Carefully remove and dispose of all existing built-up roofing membranes and flashings down to existing rigid insulation (or steel deck were replacing damaged insulation) and existing wood roof deck.

2. Wood Nailers and Blocking: See details for nailing to be removed at perimeter flashing.

   a. Carefully remove and dispose of all existing blocking, nailers, cants, curbs, decking, plates, and struts.

3. Insulation Fasteners:

   a. At metal decks, remove any screw-type fasteners as carefully as possible.

4. Existing Materials for Reuse:

   a. Carefully remove and salvage all materials designated for reuse.
   b. Any materials damaged during removal shall be repaired or replaced with equivalent new materials at no additional cost to the Owner.
   c. Any existing materials intended to be incorporated into new work shall be maintained in like new condition as judged by the Architect.

E. REMOVAL OF EXISTING ACOUSTICAL CEILING PANELS

1. Carefully remove acoustical ceiling panels and grids as needed when working above the ceilings.

END OF SECTION

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SECTION 02630 - PRECAST CONCRETE SPLASH BLOCKS

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. DESCRIPTION OF WORK

1. The work required under this section consists of furnishing and installing precast concrete splash blocks where indicated on the drawings.

C. QUALITY ASSURANCE

1. Code and Standards: Comply with all applicable requirements of the latest edition of the Internatiional Building Code.

PART 2 - PRODUCTS

A. MATERIALS

1. Splash Block to be precast and delivered to the site as a finished unit ready for installation.

   a. Concrete Mix: 4000 psi min. compressive strength at 28 days - bag 3/4 MSA.
   b. Size of block to be 2'-6" X 1'-0' x 3" thick.

B. MANUFACTURES

1. Manufacturers offering products as outlined above include: DURA CRETE INC.

PART 3 - EXECUTION

A. DELIVERY AND COORDINATION

1. Coordinate the delivery of splash blocks to the site with the finishing of the roofing work.

   a. Place splash blocks below the discharge of the roof drains in the locations where indicated on the drawings.

B. CLEAN UP

1. Clean up all debris or left over materials associated with the installation of these splash blocks.

END OF SECTION

SECTION 03310-CONCRETE

Part 1-GENERAL

A. RELATED DOCUMENTS
The general provisions of the contract, including General and Supplementary Conditions apply to the work specified as well as all codes and standards referenced.

B. DESCRIPTION OF WORK

1. Concrete forming.
2. Concrete reinforcing.
3. Concrete placing.
4. Concrete curing.
5. Concrete testing and quality control.

C. RELATED WORK SPECIFIED ELSEWHERE

None.

D. CODES AND STANDARDS

1. ACI 301, “Specifications for Structural Concrete Buildings”.
2. ACI 318, “Building Code Requirements for Reinforced Concrete”; comply with applicable provisions except as otherwise indicated.
3. CRSI, Standard for Placement of Reinforcing Steel.

E. SUBMITTALS

1. Concrete Mix Designs.
2. Accessories and Admixtures Manufacturer’s Data.
3. Test Reports: Testing laboratory will submit the following reports directly to the Architect and Owner, and shall copy the contractor and owner.
    a. Slump
    b. Air content
    c. Compressive strength
    d. Steel reinforcing mill test report

F. QUALITY ASSURANCE

1. Refer to Section 01400 for testing requirement. The Contractor will employ a separate testing laboratory suitable to the Owner to evaluate concrete delivered to and placed at site.
2. Contractor’s testing laboratory will perform sampling and testing during concrete placement, which may include the following, as directed by Architect. This testing

does not relieve Contractor of responsibility of providing concrete in compliance with specifications. Contractor may perform additional testing as necessary, at no expense to Owner, to ensure quality of concrete.

3. Sampling: ASTM C 172.

4. Slump: ASTM C 143, one test for each load at point of discharge.

5. Air-Content: ASTM C 173, one for each set of compressive strength specimens.

6. Compressive-Strength: ASTM C 39, one set for each 50 cu. yds. or fraction thereof of each class of concrete; one specimen tested at 7 days, one specimen tested at 28 days, and one retained for later testing if required.

7. When the total quantity of a given class of concrete is less than 50 cu. yds. strength tests may be waived by Architect if field experience indicates evidence of satisfactory strength.

8. Test-results will be reported in writing to Architect, Contractor and concrete producer on same day tests are made.

9. Laboratory-Reports: Submit 2 copies of laboratory test or evaluation reports for concrete materials and mix designs.

10. Manufacturer's-Data: Submit manufacturer's product data with installation instructions for proprietary materials including reinforcement and forming accessories, admixtures, joint materials, hardeners, curing materials and others as requested by Architect.

G JOB CONDITIONS

Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities, and residents. Utilize flagmen, barricades, warning signs and warning lights as required.

Part 2-PRODUCTS

A. CONCRETE MATERIALS:

1. Portland-Cement: ASTM C 150, Type I.

2. Mix-Proportions-and-Design: Proportion mixes complying with mix design procedures specified in ACI 301.

   a. Footings, Foundations and Slabs not exposed to weather: 3000 psi concrete slump 4" plus or minus 1" water/cement ratio .50 maximum.
   b. Exterior slabs, curb and gutter: 4000 psi concrete, slump 4" plus or minus 1" water/cement ratio .45 maximum.

3. Submit-written-report to Architect for each proposed concrete mix at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and are acceptable to Architect.
4. Mix-designs may be adjusted when material characteristics, job conditions, test results or other circumstances warrant. Do not use revised concrete mixes until submitted to and accepted by Architect.

5. Use-air-entering-admixture in all concrete, providing not less than 4% nor more than 8% entrained air for concrete exposed to freezing and thawing, and from 2% to 4% for other concrete.

6. Fly-Ash: ASTM C 618, Type C or F.

   a. Limit-use of fly ash in concrete mix design to not exceed 15% of cement content by weight.

7. Aggregates: ASTM C 33, except local aggregates of proven durability may be used when acceptable to Architect.

8. Water: Drinkable.

9. Air-Entraining-Admixture: ASTM C 260.

10. Water-Reducing-Admixture: ASTM C 494; type as required to suit project conditions. Only use admixtures which have been tested and accepted in mix designs, unless otherwise acceptable.

11. Accelerators: Use only non-chloride accelerators. Use of calcium chloride is not approved.

B. RELATED MATERIALS:

1. Waterstops: flat dumbbell or centerbulb type, size to suit joints, of either rubber (CRD C 513) or PVC (CRD C 572).

2. Moisture-Barrier: Clear 8-mils thick polyethylene; polyethylene-coated barrier paper; 1/8” thick asphalt core membrane sheet.

3. Membrane-Forming-Curing-Compound: ASTM C 309, Type I.

C. FORM MATERIALS:

1. Provide-form-materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.

2. Exposed-Concrete-Surfaces: Suitable material to suit project conditions.

D. REINFORCING MATERIALS:

1. Deformed-Reinforcing-Bars: ASTM A 615, Grade 60 unless otherwise indicated.

   a. Reinforcing bars shall be free of rust, scale, or other coatings at time of delivery and installation.
   b. Deliver bars separated by size and tagged.
   c. Properly protect rebar on site after delivery.

2. Epoxy Coated Reinforcing Bars: comply with ASTM A 775-89a, “Specification for Epoxy Coated Reinforcing Bars”.

3. Welded-Wire-Fabric: ASTM A 185.

PART 3-EXECUTION

A. FORMING AND PLACING CONRETE

1. Ready-Mix-Concrete: ASTM C 94.

B. FORMWORK

1. Construct so that concrete members and structures are of correct size, shape, alignment, elevation and position.

2. Provide-openings in formwork to accommodate work of other trades. Accurately place and securely support items built into forms.

3. Clean-and-adjust forms prior to concrete placement. Apply form release agents or wet forms, as required. Retighten forms during concrete placement if required to eliminate mortar leaks.

4. Leave forms in place until concrete has attained sufficient strength to support self-weight plus applied loads. Reshore slabs where the weight of slabs above will be supported.

5. Contractor is responsible for design of all forming and shoring and reshoring.

C. REINFORCEMENT

1. Position, support, and secure reinforcement against displacement. Locate and support with metal chairs, runnes, bolsters, spacers and hangers, as required. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

   Follow CRSI recommendations for placing and securing bars.

2. Required concrete protection coverage around bars for various conditions:

   a. Cast against earth 3”
   b. Exposed to weather #6 and larger 2”
   c. Exposed to weather #5 and smaller 1-1/2”

3. Bend bars cold.

4. Accurately place and support with chairs, bar supports, spacers, or hangers, except in slab work on grade.

5. Supports for bars in slabs on grade and footings shall be on plain concrete blocks.

6. Securely anchor and tie reinforcing bars.

7. Avoid splicing of bars at points of maximum stress.

8. Lap bars as follows:

   a. Compression splices-36 bar diameters.
   b. Tension splices-ACI Class B.
   c. Minimum splice length 12 inches.
   d. For epoxy coated rebar, increase lap lengths 150 per cent.

9. In columns, splice vertical bars only at points of lateral support such as at floors and shall consist of 36 bar diameters.

10. Steel reinforcing bars shall run continuous through construction joints.

11. Install-welded-wire-fabric in as long lengths as practicable, lapping at least one mesh.

D. JOINTS

1. Provide construction, isolation, and control joints as indicated or required. Locate construction joints so as to not impair strength and appearance of structure. Place isolation and control joints in slabs-on-ground to stabilize differential settlement and random cracking.

E. INSTALLATION OF EMBEDDED ITEMS

1. Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by cast-in-place concrete. Use setting diagrams, templates and instructions provided by others for locating and setting.

F. CONCRETE PLACEMENT

1. Comply with ACI, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.

2. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into forms.

3. Protect-concrete from physical damage or reduced strength due to weather extremes during mixing, placement and curing.

    a. In-cold-weather comply with ACI 306.
    b. In-hot-weather comply with ACI 305.

G. CONCRETE FINISHES

1. Exposed-to-view-Surfaces: Provide a smooth finish for exposed concrete surfaces and surfaces that are to be covered with a coating or covering material applied directly to concrete. Remove fins and projections, patch defective areas with cement grout, and rub smooth.
2. Slab-Trowel-Finish: Apply trowel finish to monolithic slab surfaces that are exposed-to-view or are to be covered with resilient flooring, paint or other thin film coating. Consolidate concrete surfaces by finish troweling, free of trowel marks, uniform in texture and appearance.

H. CURING

1. Begin initial curing as soon as free water has disappeared from exposed surfaces. Where possible, keep continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane-forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protections as required to prevent damage to exposed concrete surfaces.

END OF SECTION

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SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

A. RELATED DOCUMENTS

1. The general provisions of the Contract, including General and Supplementary Conditions and General requirements, as well as all codes and standards referenced, apply to the work specified in this section.

B. DESCRIPTION OF WORK

1. Furnish and install metal fabrications include items made of iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of other metal systems specified elsewhere.

C. RELATED WORK SPECIFIED ELSEWHERE

a. Section 09900 Painting

D. QUALITY ASSURANCE

1. All work shall be done in accordance with the following codes and standards.

a. ASTM A36 - Structural Steel.
b. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
c. ASTM A123 - Zinc Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
d. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
e. ASTM A363 - Steel Plates, Shapes, and Bars.
f. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
g. ASTM A325 - High Strength Bolts for Structural Steel Joints.
h. ASTM A569 - Steel Bar Grating
i. ASTM A53 - Steel Pipe
j. AWS A2.0 - Standard Welding Symbols.
k. AWS D1.1-88 - Structural Welding Code.
l. ASTM A500 or ASTM A501 - Steel Tubing.
m. ASTM A570 or ASTM A611, Class 1; of grade required for design loading - Structural Steel Sheets.

E. SUBMITTALS

1. In addition to product data, submit the following.

a. Shop drawings showing details of fabrication, assembly and installation including templates for anchor bolt placement after field measurements have been taken. Do not delay job progress.

1. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld

lengths.

2. Submit samples of materials and finished products as may be requested by the Architect.

F. QUALIFICATIONS

1. Welders' Certificates: Submit under provisions of Section 01300 certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

G. FIELD MEASUREMENTS

1. Verify that field measurements are as indicated on Drawings.

PART 2 - PRODUCTS

A. MATERIALS

1. All materials shall be as specified in the following standards below:

a.	Steel Sections:	ASTM A36. (Channels, angles, etc.)
b.	Steel Tubing:	ASTM A500, Grade B.
c.	Plates:	ASTM A36.
d.	Pipe:	ASTM A53, Grade B Schedule 40.
e.	Fasteners:	as noted on structural drawings.
f.	Bolts, Nuts, and Washers:	ASTM A325.
g.	Welding Materials:	AWS D1.1-88; type required for materials being welded.
h.	Non-metallic Non-Shrink Grout:	Premixed, factory-packaged, ferrous aggregate grout complying with CE CRD-C588, Type M.
i.	Shop and Touch-Up Primer:	Zinc Chromate
j.	Galvanizing:	Provide a zinc coating for those items shown or specified to be galvanized, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.
2. ASTM A123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier.
3. ASTM A386 for galvanizing assembled steel products.

2. For work exposed to view use materials selected for their smoothness and freedom from surface blemishes.

B. FABRICATION

1. All materials are to be fabricated, erected and installed by trained personnel and as outlined below:

a. Fit and shop assemble in largest practical sections, for delivery to site.
b. Fabricate items with joints tightly fitted and secured.
c. Continuously seal joined members by continuous welds.
d. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt

tight, flush, and hairline. Ease exposed edges to small uniform radius.

e. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

f. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

C. FINISHES

1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

2. Do not prime surfaces in direct contact with concrete or where field welding is required.

3. Prime paint items with one coat.

   a. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise indicated.
   b. Apply one shop coat to fabricated metal items, except apply 2 coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

4. Galvanize in accordance with ASTM A123, structural steel members. Provide minimum 1.25 oz/sq ft galvanized coating.

PART 3 - EXECUTION

A. EXAMINATION

1. Verify that field conditions are acceptable and are ready to receive work. **Field measure all work prior to fabrication.**

2. Beginning of installation means erector accepts existing conditions.

B. PREPARATION

1. Clean and strip primed steel items to bare metal where site welding is required.

2. Supply items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

C. INSTALLATION

1. Install items plumb and level, accurately fitted, free from distortion or defects.

2. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

3. Field weld components indicated on Drawings.

4. Perform field welding in accordance with AWS D1.1.

5. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.

6. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

D. ERECTION TOLERANCES

1. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

2. Maximum Offset From True Alignment: 1/4 inch.

E. MISCELLANEOUS METAL FABRICATIONS

1. Loose bearing and leveling plates:

   a. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2. Miscellaneous framing and supports:

   a. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.
   b. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

F. INSTALLATION GENERAL

1. Fastening to in-place construction

   a. Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

2. Cutting, Fitting and Placement

   a. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.
   b. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
   c. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

3. Fit exposed connections

    a. Fit accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dipped galvanized after fabrication, and are intended for bolted or screwed field connections.

4. Field Welding

    a. Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

G. ADJUST AND CLEAN

1. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal is specified in Division 9 of these specifications.

2. For galvanized surfaces: Clean field welds, bolted connections and abraded areas and apply 2 coats of galvanizing repair paint.

END OF SECTION

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SECTION 06100 – ROUGH CARPENTRY

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. The general provisions of the contract, including General and Supplementary conditions and General Requirements, as well as all codes and standards referenced, apply to the work specified in this section.

B. DESCRIPTION OF WORK:

1. Work included: work consists of furnishing all labor, material and equipment necessary for completion of the following work:

    1. Reinforcing of existing roof deck for mechanical equipment and openings thru the existing roof deck.
    2. Preservative and fire retardant treatment of wood members as required.
    3. All other work normally related to the above or specified under this section.
    4. Installation of items specified in Sections 06165 Wood panel Product Sheathing and 06182 Glue-Laminated Structural Units.

C. QUALITY ASSURANCE:

1. Reference Standards:

    a. Wood Framing: Comply with requirements of INTERNATIONAL BUILDING CODE 2003 Edition and National Design Specifications for Wood Construction, 1982 Edition, as published by the National Forest Products Association.
    b. Lumber: Comply with Grading Rules for Western Lumber, 4th Edition, May 15, 1977, as published by the Western Wood Products Association.
    c. Redwood Comply with Standards Specifications for Grades of California Redwood Lumber, as published by Redwood Inspection Service.

2. Grade Stamps: (All lumber to be grade stamped).

    a. Lumber: Each piece shall be WWPA grade stamped.
    b. Redwood: Each piece shall be RIS stamped.

D. SUBMITTALS:

Certificate: Submit plant certification stating compliance with specifications and code requirements for all fire retardant, preservative and pressure treated wood. State process used, chemical content, moisture content and finish restrictions.

E. DELIVERY AND STORAGE AND HANDLING:

Stack all material minimum of 6 inches above ground to insure proper ventilation and cover with waterproof covering.

PART 2 - PRODUCTS

A. FRAMING LUMBER:

1. Sound, thoroughly seasoned, surfaces four, sides, well manufactured and free from warp not correctable by bridging, blocking or nailing.

2. Moisture Content: Maximum of 19 percent.

3. General Framing: Douglas Fir-Larch Standard or Stud grade or better.

4. Studs: Douglas Fir-Larch No. 2 or better.

5. Plates: Douglas Fir-Larch grade or better.

6. Joists, Headers and Rafters: Douglas Fir-Larch, NO. 1 grade or better.

7. Beams, Stringers, Posts and Timber: Douglas Fir-Larch, No. 1 grade or better.

8. Blocking: Hem-Fir, Standard grade or better.

9. Furring: Hem-Fir, Standard grade or better.

10. Composite Lumber, LSL or LVL as per plans.

B. REDWOOD:

1. Sills or plates in contact with concrete: R.I.S. Grade California redwood No. 3 or better, or treated Doug-Fir No. 2.

C. METAL FRAMING ANCHORS:

1. Acceptable Manufacturers:

   a. Timber Engineering Co.
   b. Simpson Co.
   c. Or approved equal.

2. General: Provide nails and bolts according to manufactures requirements.

3. Types: Use the following types unless indicated otherwise:

   a. All purpose Framing Anchors: Simpson “A35N” or “eco All Purpose”.

D. ROUGH HARDWARE:

1. Nails: Use common wire nail lengths and diameters unless noted. Threaded, hardened steel nails may be substituted for common size nails of corresponding size. Use annular-ring, common wire, galvanized nails for plywood. Galvanized nails shall be hot-dipped galvanized, ASTM A153.

2. Bolts and Lag Screws: Common hexagonal bolts and screws, ASTM A307.

3. Washers: Provide steel washers under all heads and nuts bearing against wood. Surface area of washer to be minimum of 16 times the shank area of the receiving bolt or lag screw. Thickness not less than 1/10 of the washer diameter or length of longest side.

4. Steel Plates, Straps and Weldments: ASTM A36, size as indicated. Where welded, provide minimum of 3/16" fillet welds all sides and full length of contact surfaces unless noted. Use E60 or E70 welding electrodes. Prime with shop paint.

E. POWER-DRIVEN ANCHORS:

Ramset or equivalent low velocity power driven fasteners, minimum 1/8" shank diameter, length as required to penetrate receiving member and back-up material in accordance with manufacturer's recommendations.

F. EXPANSION BOLTS:

Comply with FS FF-S325, Group II, Type 4, size as indicated. McCullogh Industries, "KWIK-bolt Concrete Anchors", Wej-It Expansion Products, Inc. "Wej-It Concrete Anchors" or approved equal.

PART 3 - EXECUTION

A. INSPECTION:

Verify that surfaces to receive rough carpentry are prepared to required grades and dimensions. Do not begin work until unsatisfactory conditions are corrected.

B. GENERAL:

Cooperate with other trades. Provide required grounds, blocking, wood backing and framing. Perform cutting and patching or rough carpentry work as required.

C. ROUGH HARDWARE:

1. Provide and install rough hardware and metal fasteners as indicated, specified ro required for proper installation of rough carpentry.

   Countersink bolt heads into wood framing members where exposed to view unless noted otherwise.

2. General: Nail or spike members in accordance with International Building Code. Framing 16" on

center unless otherwise indicated.

Cut framing square on bearing, closely fir, accurately set to required lines and levels. Secure rigidly in place at bearings and connections. Use steel shims with full bearing on supports where required for leveling. Shims shall be physically attached to support by welding or other methods acceptable to the Architect and Structural Engineer.

Frame members for the passage of pipes and ducts to avoid cutting structural members. Do not cut, notch, or bore framing members for passage of pipes or conduits without acceptance of Architect and Structural Engineer. Reinforce framing members as directed where damaged by cutting.

Fire-stop concealed spaces in framing not shut off by framing members to prevent drafts from one space to another. Use 2" thick, accurately-fit wood blocking to fill opening.

3. Fasteners:

   a. Nails: where splitting is likely to occur, prebore nail holes ½ size of nail diameter and use threaded, hardened steel nails.

   b. Bolts: Bolt holes shall be 1/32" to 1/16" larger than the bolt diameter. Carefully center bolt hole between side plates and main members. Provide steel washers between wood and bolt heads and/or nuts.

   c. Lag Screws: Provide steel washer between wood and screw head. Provide lead holes for the screw portion as follows:

Lag Screw Nominal Diameter	Lead Hole Diameter
½ in. dia.	5/16 in. dia.
5/8 in. dia.	13/32 in. dia.
¾ in. dia.	½ in. dia.

   Lead holes for the shank shall have a diameter and length equal to the unthreaded portion of the screw shank. Lubricate screw with soap before installing.

4. Anchors: Anchor carpentry work to masonry or concrete where required. Anchors as follows, unless otherwise indicated:

   a. Wall Plates: ½" x 8" bolts with washers as 4' on center unless otherwise indicated.

   b. Partition Plates on Concrete Floors: Expansion bolts or power-driven anchors a 4' on center.

   c. Posts: Post base and post cap at each post as specified.

   d. Metal Framing Anchors: As specified or indicated.

5. Bridging:
   a. Cross Bridging: Required at joists. Use 1 x 3 strips with beveled ends, double crossed. Secure with 2-8d nails each end, nailing bottom ends after subfloor is laid. Space rows of bridging 8'-0" on center maximum.

   b. Solid Bridging: Provide between joist over all supports and as indicated; 2" x depth of framing members.

6. Studs: 2x4 at 16 in. on center, unless otherwise indicated. Single bottom plate and double top plates with joints staggered. Double studs at openings and triples at corners and intersections unless otherwise indicated. Provide double 2x8 headers over openings unless otherwise indicated. Set studs directly over joists where possible. Provide blocking as necessary. Install continuous fiberglass sill sealer under all exterior plates bearing directly on concrete. For staggered stud partitions, install 2x6 top and bottom plates with two rows of 2x4 studs 16 in. on center, staggered.

D. REDWOOD INSTALLATION:

Install as specified for wood framing installation. For exterior framing use stainless steel, aluminum or top quality hot-dipped galvanized nails. All exterior bolts and metals shall be galvanized.

E. WOOD FURRING:

Provide wood furring wood furring in sizes and spacing as indicated. Securely fasten wood furring at maximum 24" on center with toggle or expansion bolts, cut concrete nails or power-driven anchors as required. Install furring around openings and at corners. Erect furring plumb, level and shim out as required.

F. WOOD BUCKS:

Provide 2" stock, width as shown, at locations as indicated. Anchor to concrete with 3-3/8" bolts each jamb (four anchor if over 7"). Countersink heads into buck.

G. WOOD GROUNDS AND BLOCKING:

Provide grounds and blocking of size required for plaster, for securing wood trim and other work or equipment. Set true to line, level or plumb, well secured in place. Bolt blocking or nailers on steel framing.

END OF SECTION

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SECTION 06165 – WOOD PANEL PRODUCT SHEATHING

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. The general provisions of the contract, including General and Supplementary conditions and General Requirements, as well as all codes and standards referenced, apply to the work specified in this section.

B. DESCRIPTION OF WORK:

1. Includes But Not Limited To:

Furnish and install wood panel product sheathing required for roofs as described in Contract Documents.

C. SUBMITTALS:

1. Quality Assurance/Control – Submit technical and engineering data on fasteners to be set by pneumatic devices for Architect's approval of types proposed to be used as equivalents to specified hand set nails.

D. DELIVERY AND STORAGE AND HANDLING:

1. Protect sheathing and keep under cover in transit and at job site.

2. Do not deliver material unduly long before it is required.

3. Store sheathing on level racks and keep free of ground. Stack to insure proper ventilation and drainage.

PART 2 - PRODUCTS

A. MATERIALS:

1. Sheathing:
   a. Plywood meeting requirements of PS 1-83/ANSI A199.1.
      1. Except where plywood is specifically indicated on Drawings, APA performance rated waferboard, composite board and oriented strand board (but not structural particle board) are accepted as equal to plywood, providing specified span ratings and other specified requirements for plywood are met.
   b. Every sheet of sheathing shall be stamped as follows:
      1. Appropriate APA grade stamp identifying species and span rating.
      2. Sheathing shall be stamped "Sized for Spacing".

3. Exposure 1 or Exterior.

c. Sheathing shall not exceed 18 percent moisture content when fabricated nor more 19 percent when installed.
d. Sheathing ¾ inch thick and over used for subflooring shall be tongue and groove.
e. Sheathing used for same purpose shall be of same thickness. In all cases, thickness specified is minimum required regardless of span rating.
f.

Thickness	Span Rating
15/32 inch actual	32/16
½ inch nominal	32/16
19/32 inch actual	40/20
5/8 inch nominal	40/20
23/32 inch actual	48/24
¾ inch nominal	48/24

2. Nails
   a. 15/32 inch & thicker panels – 10d common or galvanized.

PART 3 - EXECUTION

A. INSTALLATION:

1. General
   a. Top of nail heads shall be flush with the sheathing surface.
   b. Use of edge clips to provide spacing between sheathing panels is acceptable.
      2.
2. Roofing Sheathing:

   a. Placing:
      1. Lay face grain at right angles to supports. Provide blocking for support where framing turns a roof overhang.
      2. Provide 1/8 inch space between sheets at end and side joints.
      3. Stagger panel end joints.
      4. Sheathing shall be continuous of two spans minimum.
   b. Nailing (Unless noted otherwise on Drawings):
      1. Place nails at least 3/8 inch in from edge.
      2. Nail 6 inches on center along supported edges.
      3. Nail 12 inches on centers on intermediate supports.
      4. Nail 4 inches on center at:
         a. Diaphram boundaries.
         b. Blocking above plywood sheathed walls and block masonry walls.
         c. At shear wall struts and fascias.
   c. Thickness-15/32 inch actual minimum.

B. PROTECTION:

1. Protect roof sheathing from moisture until roofing is installed.

END OF SECTION

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SECTION 07538-THERMOPLASTIC POLYOLIFIN ROOFING(TPO)

Part 1-GENERAL

1.1 Summary

A. Includes but not limited to:
1. Furnish and install mechanically fastened roofing system and fully adhered roofing system at parapet walls (if required) as described in Contract Documents.
2. Remove existing roofing and flashings.
3. Install tapered insulation where shown on drawings.
4. Blocking and nailer installation.
5. Membrane installation.
6. Metal flashings.

B. Products Installed but not Furnished in This Section
1. Sheet metal work including caps, sleeves, umbrella hoods, pipe enclosures boxes, strapping, and scuppers.

C. Related Work
1. Section 07600- Sheet Metal

1.2 REFEFFERENCES

A. American Society For Testing

1. ASTM C 208-95, 'Specification for Cellulosic Fiber Insulating Board'
2. ASTM C564-97, 'Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings'
3. ASTM C 920-98, 'Standard Specification for Elastomeric Joint Sealants
4. ASTM 6878, Specification for Thermoplastic Polyolefin Based Sheet Roofing

1.3 SUBMITALS

A. Product Data – Manufacture's literature or cut sheet for each element of system

B. Physical Properties: TPO membrane manufacturer must show printed Documentation that TPO membrane meets or exceeds the following physical properties. Any TPO membrane manufacturer that does not meet or exceed the following performance criteria will be excluded from supplying TPO roofing material on this project.

1. Thickness over Scrim: ASTM D 4637; Optical Method 0.020 mills (0.381) v 10%
2. Solar Reflectance (albedo X 100),% (Min. for energy star 7 approval is 65%) Emittance, Infrared: ASTM E 408 87 Typical for white
3. Properties after Heat Aging 28 days @ 240 degrees F
   a. Breaking Strength ASTM D 751 Grab Method: Typical 340 lbf (kN)
   b. Elongation at Break of fabric, % ASTM D751 Typical 25
   c. Tearing strength , lbf(N) 8x8 in. specimen, ASTM D715 B Tongue Tear 130(578) Typical
   d. Linear Dimensional Change ASTM D1204(shrinkage) % -0.5 Typical
   f. Ozone resistance, 100 pphm, 168 hrs ASTM D 1149: No cracks.

g. Puncture Resistance, lbf(N) FTM 101C Method 2031: 300 typical

4. Resistance to water absorption; Change in mass %: ASTM D 471: 2.0 Typical
5. Brittleness point, EF(NC): ASTM D 2137; Typical (-46)
6. Resistance to microbial surface growth rating 1 is very poor, 10 is no growth ASTM D 3274: 9-10 typical
7. Field seam strength, lbf/in. (kN/m) Seam tested in peel: ASTM 1876: 60(10.5) typical
8. Water vapor permeance, Perms ASTM E 96: 0.05 typical

9. Resistance to Xenon-Arc weathering Xenon-Arc, 17,640 kJ/m total radiant exposure, visual condition at 10X ASTM G 26 0.70 W/m 80ECB.P.T.: No cracks, No loss of breaking or tearing

C. Shop Drawings – Include outline of roof and roof size, location and type of Penetrations, perimeter and penetration details, special details And bill of materials.

D. Quality Assurance / Control

1. Two copies of manufacturers published specification for architect and maintain one at job site.
2. Roofing System Manufacturer's certification of installer.
3. Prior to beginning construction the Contractor shall furnish to Owner/Architect a (PIN) pre-installation notice.

E. Closeout-Submit record record shop drawings to Manufacturer, if requested. Record shop drawings shall be given shop drawing number by Membrane Manufacturer.

1.4 QUALITY ASSURANCE

A. Qualifications-Applicator shall be approved by Roofing System Manufacturer for a period of 5 years.

B. Regulatory Requirements – Perimeter wood blocking, insulation, and sheet Metal installation shall, as minimum, be in accordance with recommendations of FM Loss Prevention Data Sheet 1-28, 1-29, June 1996.

C. Pre-installation Meeting- Schedule meeting prior to staging and application of roofing system.

D. Roofing manufacturer must document that they have a minimum of 15 years of Manufacturing single ply roofing systems.

E. Submitted TPO membrane must meet or exceed all physical properties listed in Section 1.3 B.

F. U.L. lising:
   a. Provide roof system and component materials, which have been tested for application and slopes indicated and which Underwriters Laboratories Inc. (UL) list for **Class A** external fire exposure.

(1) Provide roof covering materials bearing UL Classification marking on bundle, package, or container indicating that materials have been produced under UL=s Classification and Follow-up Service.

1.5 DELIVERY, STORAGE and HANDLING

A. Make no deliveries to Project until installation is about to commence, or until Approved storage area is provided. Deliver and maintain materials in Manufacturers original, unopened containers or rolls, with labels intact and legible

B. Store Materials, except membranes, in dry place with temperatures between 60 and 80 deg. F. Restore materials which are allowed to become colder than specified temperature to proper temperature before using. Store materials on clean, raised platforms and with weather protective coating when stored outdoors.

C. Select and Handle operating equipment so as not to damage existing construction or new roofing system, or to overload structural system.

1.6 PROJECT CONDITIONS

A. Project Environmental Requirements
1. Temperature ranges shall be within tolerances for material being used.
2. Follow Manufactures instructions for cold temperature installation. Follow specified precautions for storage of materials and expose only enough adhesive to be used within four hours period.
3. Roof surface shall be free of ponded water, ice, and snow.
4. Do not expose membrane and accessories to constant temperature in excess of 180 deg F.

1.7 WARRANTY

A. Membrane Manufacturers written 20 year warranty covering roofing system, including insulation and membrane degradation. This warranty must be on the DFCM warranty form.

B. Membrane Manufacturers written 20 year warranty covering TPO membrane and flashings. This warranty must be on the DFCM warranty form.

C. Written 5 year guarantee workmanship and repairs or replacement of work without cost to owner, counter-signed by installer and Contractor. This warranty must be on the DFCM warranty form.

D. Provide a TPO membrane that shall be energy star rated.

E. A DFCM history record will be required as part of the warranty package.

PART 2-PRODUCTS

2.1 COMPONANTS

A. Insulation System (Defined by Roof Section)

Sections A: Total tear off to wood deck (Mechanically Attached TPO System)

1. The new 4” polyisocyanurate insulation over the wood roof deck.

2. New tapered 1/8" and ¼" per foot additional tapered Expanded Polystyrene (EPS) boards where shown on drawings.
    a. Expanded Polystyrene insulation to be 2.0 lb. Density.
    b. EPS insulation manufacturer's include:
        1. Advance Foam Plastics Inc.
           111 West Fireclay Ave.
           Murray, Utah 84107
           Phone: 801-265-3465
        2. Insulfoam
           Division of Premier Industries
           1820 South 4370 West
           Salt Lake City, Utah 84104
           Phone: 801-956-2803
        3. Styrofoam
           Dow Chemical Company/Building Materials Group
           200 Larkin
           Midland, MI 48674
           Phone: 1-866-583-2583

Sections B: Replace/repair existing insulation on existing steel roof deck where damaged.

1. Where damaged replace existing rigid insulation with polyisocyanurate insulation and tapered insulation as needed.

Sections C: Install new ¼" "Dens Deck" or equal on entire roof.

B. Roof Boards: (to be installed on the entire roof over the insulation).
1. Roof Boards fire-resistant barrier shall be Dens Deck as manufactured by Georgia Pacific Corporation, Atlanta, Georgia or equal.
    a. ¼" Dens Deck shall be glass mat facings front and back that are embedded into a water resistant gypsum core, providing fire-resistant board specifically designed to be used over wood decks or combustible insulation.

C. Roofing Membrane:

1. Reinforced TPO, (standard) 0.060 inch thick by optimum width and length determined by job conditions. Extruded Smooth TPO Membrane Only (0.020 mills above scrim).

2. Approved Manufacturer-all TPO membrane manufacturer's must document TPO membrane meets or exceeds all Quality Control Criteria. There will be no exceptions. The building owner has conducted extensive study into what typical physical properties a TPO membrane should possess for long term weathering. The TPO membrane must process ***all*** physical properties listed in this specification.

D. TPO Sealants

E. Vent Pipe Extensions
1. Pipe-Schedule 40 PVC pipe of equivalent diameter to vent pipe.
2. Connectors-Neoprene pipe sleeves with stainless steel drawband, meeting requirements of ASTM C 564.

2.2 ACCESSORIES

A. TPO Flashing

1. Thermoplastic Polyolefin Unreinforced TPO, .060 inch thick.
2. Preformed Pipe Sleeves – Factory prefabricated, .060 inch thick

B. Bonding Adhesive- TPO Bonding Adhesive as furnished by membrane manufacturer

C. Cut Edge Sealant- TPO Based squeeze tube consistency by Membrane Manufacturer.

D. Water Cut Off Mastic – As furnished by membrane manufacturer.

E. Surface Cleaner/ Primer- As furnished by membrane manufacturer.

F. Nite Seal – Furnished by Membrane manufacturer.

G. Pourable Sealer – As furnished by membrane manufacturer.

H. Termination Bars
1. Flat extruded aluminum bar with spaced holes for termination attachment furnished by membrane manufacture.
2. Extruded aluminum bar with sealant track with spaced holes for termination attachment furnished by Membrane Manufacturer

I. Termination Bar Fasteners- Threaded fasteners with expansion sleeve that provide easy future removal and reuse, furnished by Membrane Manufacturer.

J. Walk Pads
1. Walkway Pads as furnished by Membrane Manufacturer.

PART 3-EXCECUTION

3.1 PREPERATION

A. Protection
1. Prevent interior leakage, materials falling into interior, and other such Occurrences.
2. Install temporary water cut-offs at completion of each days work and completely remove upon resumption of work.

3. Provide temporary walkways and work platforms as necessary to complete work under this section with no damage to existing surfaces, surfaces exposed during work, and to new materials applied.

4. Coordinate application of membrane to provide protection of underlying materials from wetting or other damage by the elements on a continuous basis

5. Sheet metal sleeves, caps, and enclosures shall be completely installed on a daily basis.

B. Surface Preparation

1. Surfaces to receive new materials shall be free of dirt, debris, loose material and free of moisture. Mechanically scrape exposed surfaces, if necessary to remove projections.

2. Verify that surfaces receiving new materials have no defects or errors which

would result in poor application or cause latent defects in workmanship.

3. Inspect anchoring of wood members for conformance to specified requirements. Upgrade nonconforming fasteners to meet specified requirements.

4. Reset or replace fasteners that are loose, deformed, damaged, or corroded.

5. Fit joints of insulation tightly together.

3.2 INSTALLATION

A. Installation shall be in conformance with latest edition of manufacturers specification except where Contract Documents are more restrictive.

B. Insulation

1. Position first layer of insulation board with tight joints and staggered edges.
   a. Install additional layers of board insulation in offset pattern and as directed by roof Membrane Manufacturer.
   b. Lay out tapered board to provide positive flow to roof drains as shown on drawings.
   c. Fasten roof insulation assembly in pattern as directed by Membrane Manufacturer.
   d. Mechanically attach first layer of insulation board to deck as directed by Roofing Manufacturer.

2. Moisture content of insulation shall not exceed 4 percent.

3. ¼" Dens Deck or equal shall be installed as per manufacturer's directions.

3.03A MEMBRANE PLACEMENT AND ATTACHMENT (PARAPET WALLS)

A. Position TPO membrane over the acceptable substrate. Fold membrane sheet back lengthwise (onto itself) so half the underside of the membrane is exposed.

B. Apply TPO Bonding Adhesive in accordance with the manufacturer's published instructions, to the exposed underside of the membrane and the corresponding substrate area. Do not apply Bonding Adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.

1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.

2. Fold back the unbonded half of the sheet lengthwise and repeat the bonding procedures.

C. Position adjoining sheets to allow a minimum overlap of 2 inches.

D. Hot air weld the TPO membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures.

E. Pull the membrane back along the welded splice so the entire underside of the membrane is exposed once the Hot Air Weld has been completed.

F. Apply TPO Bonding Adhesive to the exposed underside of the membrane sheet and the substrate.

G. Allow adhesive to dry until tacky and roll the membrane into the substrate and brush down the bonded section with a bristle broom following the procedure noted above.

H. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 inches and complete the bonding procedures as stated previously.

3.03B MEMBRANE PLACEMENT AND ATTACHMENT (HORIZONTAL ROOF AREA)

A. Mechancially-Fastened system is a roofing system where the TPO membrane is mechanically fastened to the roof deck.

B. Place membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent attachment. Roof membrane shall be mechanically fastened immediately after it is rolled out, followed by welding to adjacent sheets.

C. Overlap roof membrane a minimum of 5” for side laps and 3” for end laps.

D. Mechanically-Fasten membrane with screws and plates according to the manufacturer’s published instructions.

E. Hot air weld the TPO membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer’s hot air welding procedures.

F. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 5 inches and complete the attachment as stated previously.

3.04 MEMBRANE SPLICING/HOT AIR WELDING PROCEDURES

A. Hot air weld membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's specifications. At all splice intersections, roll the seam with a silicone roller prior to membrane seam cooling.

B. Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes).

C. Repair all seam deficiencies the same day they are discovered.

D. Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete.

3.05 FLASHING

A. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced membrane. Non-reinforced membrane can be used for flashing pipe penetrations, Sealant Pockets, scuppers, as well as inside and outside corners when the use of pre-fabricated accessories is not feasible.

B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.06 WALKWAYS

A. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the specifier's drawing.

3.07 DAILY SEAL

A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the workday, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.

B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

3.08 CLEAN UP

A. Perform daily clean up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.

B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

END OF SECTION

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SECTION 07600 - COPINGS, FLASHINGS & SHEET METAL

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

SUMMARY:

Extent of work is indicated on the Drawings and includes the following:

New Copings.
New Gravel Stops.
Metal Storm Collars.
Counterflashings.

Related work specified elsewhere includes the following:

Membrane roofing is specified in Division 7 Section "Single Ply Membrane Roofing".

Exposed metal work:

All metal copings are to be Prefinished Painted Sheet Steel.

QUALITY ASSURANCE:

Industry Standards: Provide products which comply with applicable requirements of SMACNA "Architectural Sheet Metal Manual", except as otherwise indicated.

SUBMITTALS:

Product Data: Submit manufacturer's technical product data, installation instructions and general recommendations for each premanufactured product or prefinished material. Include data substantiating that materials and performance comply with requirements.

Shop Drawings: Submit shop drawings indicating layout, joining, profiles, accessories, anchorages, flashing connections and relationship to supporting structure and to adjoining roof and wall construction.

For verification purposes submit completely finished samples for each type of coping and sheet metal and finish required. Where normal color and texture variations are to be expected, include 2 or more units in each set of samples showing limits of such variations. Provide samples of the following sizes.

Copings: 8" long section.

JOB CONDITIONS:

Coordinate work of this section with adjoining work for proper sequencing of each installation to ensure best possible weather resistance and protection of materials and finishes against damage.

PART 2 - PRODUCTS

A. MATERIALS:

1. Zinc-Coated Steel Sheet: ASTM A 526, with G90 zinc coating, 22 gauge where not otherwise indicated.

2. Aluminum Sheet: ASTM B 209, alloy 3003, temper H14, AA-C22A41 clear anodized finish; 0.063-inch thick except as otherwise indicated.

3. Prefinished Painted Sheet Steel: ASTM A446, copper bearing galvanized steel, each face coated with a minimum 0.2 mil thick thermo-cured fluorocarbon coating containing "Kynar 500" resin, over 1.0 mil minimum thick inhibiting thermo-cured primer, 24 gauge (0.0239"), of manufacturer's standard color as selected by Architect.

4. Exposed Fasteners: Stainless steel, non-magnetic screws of type and size standard with manufacturer for product and application indicated. Provide all weather-exposed fasteners with 5/8" diameter neoprene gaskets.

5. Concealed Fasteners: Screws or rivets of same metal as item fastened or other non-corrosive metal as recommended by manufacturer.

6. Mastic Sealant: Single-component acrylic sealant; ASTM C 920 Type S Class 12.5 Grade NS, or FS TT-S0-00230 Class B Type Non-sag; solids 95% acrylic.

7. TPO Seal: Manufacturer's standard.

8. Adhesives: Type recommended by manufacturer for substrate and project conditions, and formulated to withstand min. 60 psf uplift force.

B. MANUFACTURERS

1. Manufacturers will be selected from the following, depending on the color selected:
   a. Atlas International, Inc.
   b. Berridge Manufacturing Company
   c. Copper Sales, Inc., Una-Clad
   d. Englert
   e. MM Systems Corporation
   f. Metal Sales Manufacturing Corporation
   g. PAC-Peterson Aluminum Corporation
   h. Vincent Metal Goods

C. FABRICATED UNITS:

1. General Metal Fabrication

    a. Factory or shop fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual," and other recognized industry standards.
    b. Fabricate for waterproof and weather resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of work.
    c. Comply with material manufacturer's recommendations for forming material. Form exposed work without excessive oil canning, buckling, and tool marks, true to lines and levels indicated, with exposed edges folded back to form hems.

2. Expansion Provisions
    a. Fabricate running sheet metal work and copings to allow controlled expansion in running lengths not only for movement of metal components in relationship to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner which is sufficient to prevent water leakage, deformation or damage.

D. EXPANSION JOINTS:

1. Shop fabricated units of galvanized and formed sheet steel in longest practical lengths with interlocking 1" high standing seams, and integral hemmed drip edge.

2. Fabricate of metal thickness indicated, but not less than 22 gauge.

E. SCUPPERS:

1. Shop or factory fabricated of formed galvanized sheet steel and lead sheets of sizes and configurations indicated. Material thickness as indicated, but not less than 22 gauge.

F. COUNTERFLASHINGS AND REGLETS:

1. Shop fabricated or pre-manufactured system of reglets designed for surface-mounting with removable compression-type counterflashing which is held in place by spring action.

2. Fabricate or zinc-coated sheet steel; thickness of material as indicated, but not less than 22 gauge.

G. COPING SYSTEM:

1. Shop or factory system of formed prefinished metal coping, and formed splice plates; thickness of coping as indicated, but not less than 24 gauge.

2. Joints: Standing seam or drive joint.

3. Space coping anchors at 12-inch minimum spacing, unless otherwise noted. Install heavy gauge hold down cleats on both sides of coping.

PART 3 - EXECUTION

A. INSTALLATION REQUIREMENTS:

1. General

Comply with manufacturer's written installation instructions and recommendations.
Coordinate with installation of roof deck and other substrates to receive work of this section, with vapor retarders, roof insulation, roofing membrane, flashing, and wall construction, as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight.
Anchor products included in this section securely to structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

Isolation: Where metal surfaces of units are installed in contact with dissimilar metal or corrosive substrates, including wood, concrete or masonry, apply approved permanent separation coating on concealed metal surfaces as recommended by manufacturer.

Anchor work in place with non-corrosive fasteners, adhesives, setting compounds, tapes and other materials and devices as recommended by manufacturer or each material or system. Provide for thermal expansion and building movements.

Comply with recommendations of "Architectural Sheet Metal Manual" by SMACNA.

Seal moving joints in metal work with elastomeric sealants, complying with FS SS-T-00227, -00230, or 001543.

Install counterflashings in reglets, using snap-in seal arrangement. Fill reglet with mastic or elastomeric sealant.

H. CLEANING AND PROTECTION:

1. Clean metal surfaces of soldering flux and other substances which could cause corrosion.

a. Clean exposed metal surfaces in accordance with manufacturer's instructions.
b. Touch-up damaged metal coatings.

2. Protection

a. Provide protective measures as required to ensure that work of this section will be without damage or deterioration at time of substantial completion.

END OF SECTION

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SECTION 07615 – METAL EQUIPMENT SCREEN

PART 1 - GENERAL

A. RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General requirements, as well as all codes and standards referenced, apply to the work specified in this section.

B. DESCRIPTION OF WORK

1. This section shall include, but is not limited to, the furnishing of all labor, materials, tools, equipment and services for all preformed equipment screens as indicated, in accordance with provisions of contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound secure and complete installation.

C. RELATED WORK SPECIFIED ELSEWHERE

Section 05500	Metal Fabrications
Section 06100	Rough Carpentry
Section 07600	Copings, Flashings and Sheet Metal
Section 09900	Painting

D. QUALITY ASSURANCE

1. Applicable Standards:

a. SMACNA:	“Architectural Sheet Metal Manual” Sheet Metal and Air Conditioning Contractors National Association, Inc.
b. AISC:	“Steel Construction Manual” American Institute of Steel Construction.
c. AISI:	“Cold form Steel Design Manual” American Iron and Steel Institute
d. ASTM A792-AZ50:	Specifications for steel sheet, aluminum-zinc alloy coated (galvanized) by the hot dip process, general requirements (galvalume).

2. Manufacturer’s Qualifications:

a. Manufacturer has a minimum of three years experience in manufacturing panels of this

nature.

3. Installer's Qualifications:

   a. Installation of panels and accessories by installers with minimum of two years experience in panel project of this nature.

E. SUBMITTALS

1. Submit product data under provisions of Section 01300.

2. Provide structural, physical and environmental characteristics, size, limitations, special handling or installation requirements.

3. Provide data on glazing sealant. Identify color available.

4. Shop Drawings:

   a. Submit complete shop drawings and erection details to Architect for review. Do not proceed with manufacture prior to review of shop drawings. Do not use drawings prepared by Architect for shop or erection drawings.
   b. Shop drawings show methods of erection, elevations and plans of roof and wall panels, sections and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with all materials not supplied and proposed identification of components parts and their finishes.

5. Samples:

   a. Submit samples and color chips for all proposed finishes.
   b. Submit one 8" long sample of panel, including clips.
   c. Submit two 3" x 5" color chip samples in color selection by Architect.

F. GUARANTEE

1. Metal panel manufacturer, upon final acceptance for project, furnish a warranty covering bare metal against rupture, structure failure and perforation due to normal atmospheric corrosion exposure for a period of twenty (20) years.

2. Covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chaulking and fading for a period of twenty (20) years.

G. PRODUCT DELIVERY, STORAGE AND HANDLING

1. Delivery: Deliver panels to jobsite properly packaged to provide protection against transportation damage.

2. Handling: Exercise extreme care in unloading, storing and erecting panels to prevent bending, warping, twisting and surface damage.

3. Storage: Store all material and accessories above ground on well skidded platforms. Store under waterproof covering. Provide proper ventilation to panels to prevent condensation build-up between each panel.

PART 2 - PRODUCTS

A. ACCEPTABLE MANUFACTURERS

1. Subject to the compliance with requirements, provide products of the following manufacturers:

   a. Amco Roof Systems
   1 Oxford Center 14th Floor
   301 Grant Street
   Pittsburgh, PA. 15219-1415
   (800) 231-1054

   b. MBCI
   1887 South 700 West
   Salt Lake City, Utah 84104
   (801) 973-0911

B. MATERIALS

1. Panel Profile: (Shadowrib) 3" deep x 16" wide with 1-1/2" deep x 5-1/2" wide fluting.

2. Panel Style: Fluted face with metal panel clips anchored to horizontal girts with two ¼" x 1" Tek 2 fasteners. Clips to line up with each rib of panel.

3. Gauge: 22 gauge.

4. Texture: Smooth.

5. Finish: Premium fluorocarbon coating produced with Kynar 500.

6. Color: Selected from manufacturer's standard line.

C. FABRICATION

1. Material shall be in-line tension leveled prior to roll forming finished panel profile.

2. Roll form panels in continuous lengths, full length of detailed runs,

3. Standard panel length shall be no more than 45 feet.

4. Fabricate trim, flashing and accessories to detailed profiles.

5. Fabricate trim and flashing from same material as panel.

PART 3 - EXECUTION

A. SURFACE CONDITIONS

1. Examination:

   a. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.
   b. Verify that installation may be made in accordance with approved with approved shop drawings and manufacturer's instruction.

2. Discrepancies:

   a. In event of discrepancy, notify Architect. Do not proceed with installation until discrepancies have been resolved.

B. INSTALLATION

1. Install panels so that they are weather tight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.

2. Install panels in accordance with manufacturer's instructions and shop drawings.

3. Provide concealed anchors at all panel attachment locations.

4. Install panels plumb, level and straight with seams and rib parallel, conforming to design indicated.

C. CLEANING, PROTECTION

1. Dispose of excess materials and remove debris from site.

2. Clean in accordance with manufacturer's recommendations.

3. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the Architect, any work that becomes damaged prior to final acceptance.

4. Touch up minor scratches and abrasions.

END OF SECTION

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SECTION 08300 – ROOF SCUTTLE

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 General Requirement Sections apply to the work of this Section.

B. DESCRIPTION OF REQUIREMENTS:

1. Furnish and install metal roof scuttle.

C. RELATED WORK SPECIFIED ELSEWHERE:

Section 07538 Single Membrane Roofing System

D. QUALITY ASSURANCE:

1. Manufacturers offering products to comply with the requirements for metal roof scuttle include the following:

   a. The Bilco Company.

2. Manufacturer shall guarantee against defects in material and workmanship for period of five years.

   (1) Remove debris.
   (2) Sweep and wash paved areas involved in construction.
   (3) Police yards and grounds of construction debris.

PART 2 – PRODUCTS

A. MATERIALS:

1. Steel Roof Access Door (type “S” roof scuttle, 3’-0” x 2’-6”, 2’-6” is hinge side)

   a. Cover shall be 14 gauge paint bond galvanized steel with 3” beaded flange, neatly welded. Insulation shall be fiberglass 1” thickness, fully covered and protected by a metal liner of 14 gauge paint bond galvanized steel.
   b. Curb shall be 12” in height and of 14 gauge paint bond galvanized steel. It shall be formed with a 3-1/2” flange with holes provided for securing to the roof deck. Curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners for weather-tightness. Insulation on the exterior of the curb shall be rigid fiberboard 1” in thickness.
   c. Scuttle shall be completely assembled with heavy pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles and padlock hasps inside and outside, and heavy extruded EPDM rubber gasket. Cover shall be

equipped with an automatic hold-open arm complete with red vinyl grip handle to permit easy release and one hand control of the cover to its closed and latched position.

d. All hardware shall be zinc plated and chromate sealed and factory finish shall be mill finish aluminum.

PART 3 – EXECUTION

A. INSTALLATION:

1. Coordinate installation of roof access hatch with roofing.
2. Installation shall be in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 08800 – GLASS AND GLAZING

PART 1 - GENERAL

A. RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General requirements, as well as all codes and standards referenced, apply to the work specified in this section.

B. DESCRIPTION OF WORK

Glass and glazing for exterior aluminum frame.

C. RELATED WORK SPECIFIED ELSEWHERE

a. Section 07900 Joint Sealant
b. Section 08900 Aluminum Window Systems

D. QUALITY ASSURANCE

1. Standards and specifications: Comply with applicable standards and specifications of the following organizations, except as specified otherwise in this section.

   a. Flat Glass Marketing Association, Glazing and Sealant Manual.
   b. Manufacturers of products specified herein.

E. REFERENCES

1. ANSI Z97.1 – Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.

2. FS DD-G-1403 – Glass, Float or Plate, Figured (Flat, for Glazing, Mirrors and Other Uses).

3. FS DD-G-1403 – Glass, Plate Float, Figured, and Spandrel (Heat Strengthened and Fully Tempered).

4. FS TT-G-410 – Glazing Compound, Sash (Metal) for Back Bedding and Face Glazing.

5. FS TT-S-1543 – Sealing Compound: Silicone Rubber Base (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

6. SIGMA No. 64-7-2 – Specification for Sealed Insulating Glass Units.

7. FGMA – Glazing Sealing Systems Manual.

F. SUBMITTALS

1. Submit product data under provisions of Section 01300.

2. Provide structural, physical and environmental characteristics, size, limitations, special handling or installation requirements.

3. Provide data on glazing sealant. Identify color available.

G. DELIVERY, STORAGE, AND PROTECTION

1. Deliver products to site under provisions of Section 01600.

2. Store and protect products under provisions of Section 01600.

H. WARRANTY

1. Provide five year manufacturer's warranty under provisions of Section 01700.

2. Warranty: Include coverage of sealed glass units from seal failure, interpane dusting or misting and replacement of same.

I. DESCRIPTION

1. Glass and Glazing: Provide systems that have been produced, fabricated and installed which withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealant or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the work.

2. Definitions:

   a. Normal thermal movement: That resulting from ambient temperature range of 120 degrees F. and from consequent temperature range within glass and glass framing members of 180 degrees F.

PART 2 - PRODUCTS

A. ACCEPTABLE GLASS MANUFACTURERS

1. Approved by Architect.

   a. PPG Industries
   b. Guardian Industries
   c. Ford, Glass Division
   d. Libbey-Owens-Ford
   e. Saint-Gobain

2. Manufacturer's labels showing strength and quality required on glass.

3. Thicknesses: As indicated or specified, or if not indicated or specified as recommended by glass

manufacturer for application indicated.

4. Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

B. GLASS MATERIALS

1. Clear Float Glass: ASTM C1036; type I, (transparent glass, flat), Class I, (clear) quality q-3 (glazing select).

C. HEAT TREATED GLASS

1. Manufacturing process: By or horizontal (roller hearth) process.

2. Clear heat-treated float glass: ASTM C1048; condition A (uncoated surfaces), type I (transparent glass, flat), Class I (clear), quality q-3 (glazing select).

3. Kind: FT (fully tempered), where indicated or specified, or as required by codes.

4. Tinted heat-treated float glass: ASTM C1048, condition A (uncoated surfaces), Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), quality q-3 (glazing select), with tint color and performance characteristics for ¼" thick glass matching those indicated for non-heat-treated tinted float glass.

5. One-way heat-treated float glass: ASTM 61048, coated surface, Type I, Class 2, one way vision glass.

D. GLAZING MATERIALS

1. Compatibility: Select glazing sealant and type of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.

3. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant which complies with ASTM C920 requirements; including those for Type, Grade, Class and Uses.

4. Colors: Provide color of exposed sealants as selected by Architect from manufacturer's standard colors.

5. Glazing Gaskets: Neoprene, complying with ASTM C864, of profile and hardness required to maintain weathertight seal.

6. Miscellaneous Glazing Materials:

    a. Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.
    b. Cleaners, primers and sealers: Type recommended by sealant or gasket manufacturer.
    c. Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with gazing sealants, 80 to 90 Shore A durometer hardness.
    d. Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape, and hardness recommended by glass and sealant manufacturers for application indicated.
    e. Edge blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

PART 3 - EXECUTION

A. INSPECTION

1. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.

2. Beginning of installation means acceptance of substrate.

B. PREPARATION

1. General: Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are included in referenced standards.

2. Expansion and Contraction: Make necessary provision.

3. Glass sizes as indicated on drawings are approximate only. Furnish glass in correct sizes.

4. Clean contact surfaces with solvent and wipe dry.

5. Seal porous glazing channels or recesses.

6. Prime surfaces scheduled to receive sealant.

C. EXTERIOR DRY METHOD (PREFORMED GLAZING)

1. Cut glazing tape to length; install on glass pane. Seal corners by butting tape and dabbing with butyl sealant.

2. Place setting blocks at ¼ points.

3. Rest glass on setting blocks and push against fixed stop with sufficient pressure to attain full contact at perimeter of pane.

4. Install removable stops without displacement of glazing spline. Exert pressure for full continuous contact.

D. CLEANING

1. After installation, mark pane with an “X” by using plastic tape or removable paste.

2. Remove glazing materials from finish surfaces.

3. Remove labels after work is completed.

E. GLASS SCHEDULE

1. See drawings for glass type locations.

F. PROTECTION

1. Protect materials from damage. Provide warning signs and tapes on glass to insure safety of personnel on job site.

G. SUBSTANTIAL COMPLETION CLEANING

1. Damage and cleaning: Glass which is chipped, cracked, or otherwise damaged, shall be replaced until acceptance of building without additional charge. Remove smears, tapes, manufacturer’s labels, and dirt. Wash and polish glass. Do not scratch glass.

END OF SECTION

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SECTION 08900 – ALUMINUM WINDOW SYSTEMS

PART 1 - GENERAL

A. RELATED DOCUMENTS

1. The general provisions of the Contract, including General and Supplementary Conditions and General requirements, as well as all codes and standards referenced, apply to the work specified in this section.

B. DESCRIPTION OF WORK

1. Furnish and install all necessary materials, labor and equipment for the complete installation of aluminum framing as shown on the drawings and specified herein.

C. RELATED WORK SPECIFIED ELSEWHERE

a. Section 07600 Copings

D. QUALITY ASSURANCE

1. Drawings and specifications are based upon the Series #451, (2" x 4-1/2" center glazing system for 1" glass) as manufactured by United States Aluminum Corporation. Whenever substitute products are to be considered, supporting technical literature, samples, drawings and performance data must be submitted to make a valid comparison of the products involved. Test reports certified by an independent test laboratory must accompany request.

Other Manufacturers offering similar products:
Capitol
Kawneer
Vista Wall

2. Field Measurements:

When possible, take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting of the work. Otherwise, indicate field measurements on final shop drawings.

3. Contractor shall make provisions in his system for any expansion of the materials.

E. REFERENCES

American National Standards Institute (ANSI), 11 W. 42nd St., 13th Floor, New York, NY 10036, 212-642-4900, Fax: 212-398-0023.

National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269, 800-344-3555, 617-770-300, Fax: 617-984-7057.

Underwriters Laboratories (UL), 333 Pfingsten Road, Northbrook, Il 60062, 847-272-8800, Fax: 847-

272-8129.

International Standards Organization (ISO).

F. SUBMITTALS

1. Submit manufacturer's specifications and installation instructions.

2. Comply with Section 01300 submit hardware schedule for approval.

a.	Product Data:	Provide manufacturer's product and complete installation data for all materials in this specification.
b.	Shop Drawings:	Show profiles, joining methods, location of components, anchorage details, adjacent construction interface and dimensions as well as all necessary wiring and electrical requirements.
c.	Samples:	Sized to adequately represent material.
d.	Contract Closeout:	Submit the manufacturer's warranty and performance certifications.
e.	Installation Guide:	Provide written installation guide and/or installation recommendations.

G. JOB CONDITIONS

1. Installer must examine the conditions under which the window system is to be installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

H. PERFORMANCE REQUIREMENTS

1. Air Infiltration: shall be tested in accordance with ASTM E 283. Infiltration shall not exceed .06 CFM per square foot of fixed area.

2. Water Infiltration: shall be tested in accordance with ASTM E 331. No water penetration at test pressure of 6.24 PSF.

3. Structure Performance: shall be based on a maximum deflection of 1/175 of the span. The System shall perform to this criteria under a windload of 20 PSF.

I. QUALITY ASSURANCE

1. Swinging door operator shall be Certified by the manufacturer to meet performance design criteria according to the following test standards:
   a. ANSI A156.19.
   b. NFPA 101.
   c. Underwriter's Laboratories 325 (UL) listed.

d. C-UL Certified (equivalent to CSA certified).
e. ICBO (IBC Standard 10-1).

2. Automatic Swinging Door Operator: Shall be manufactured in an ISO 9001 registered manufacturing facility.

J. GUARANTEE

Submit 2 copies of written guarantee, signed by the contractor and by the window system contractor, agreeing to repair or replace defective materials and workmanship of the window system work for a period of 1 year.

PART 2 - PRODUCTS

A. MATERIALS

1. Materials shall be 6063-T5 alloy and temper (ASTM B221 alloy G.S. 10A-T5). Fasteners, where exposed, shall be aluminum, stainless steel or zinc plated steel in accordance with ASTM A 164. Perimeter anchors shall be aluminum. Glazing gaskets shall be EPDM elastomeric extrusions or vinyl reinforced with fiberglass cord to prevent stretching.

2. Jambs and major portions of doors shall have a minimum wall thickness of .188".

3. Face dimensions of door components shall be 3-1/2" for vertical stiles, 3-3/16" for top rail and 6 ½" (plus ½" for glass stops) for bottom rail. Frame sections shall be tubular members and shall provide for flush glazing of sidelites and transom areas.

4. Applied stops shall be allowed at header bar only.

5. Overall dimension of framing members shall be 2" x 4-1/2" to accommodate 1" glass.

6. Frames for offset doors shall feature snap-in door stops with continuous weatherstripping.

7. Screws, nuts, washers, bolts, rivets and other fastening devices, shall be aluminum, stainless steel or other non-corrosive materials.

B. DOOR CONSTRUCTION

Door stiles and rails shall be tubular sections, sections, accurately joined at corners with heavy concealed reinforcement brackets secured with bolts and screws, and shall be MIG welded. Doors shall have snap-in stops with bulb glazing gasket both sides of glass. No exposed screws shall be permitted. Each door leaf shall be equipped with an adjusting mechanism, located in the top rail near the lock stile, which provides for minor clearance adjustments after installation. Door bottom rail shall receive a concealed weatherstripping insert.

C. HARDWARE

Hardware for aluminum doors and door frames shall be the entrance manufacturers standard. Coordinate and install all portions of the Automatic Door Openers and Security Entry System. Coordinate items to be finished under 08710, Finish Hardware and Section Division 16, Electrical.

D. FINISHES

All exposed framing surfaces shall be free of scratches and other serious blemishes. Aluminum extrusions shall be given a caustic etch followed by an anodic oxide treatment to obtain an architectural Class 1anodic coating conforming to Aluminum Association Standard AA-MI2 C22 A44. Color to be selected from Manufacturers Standard Colors-Paint Finish. Verify sample of finish with Architect prior to manufacturing.

E. FABRICATION

The framing system shall provide continuous head and sill channels splice together with formed brake metal sleeves at center pf vertical mullions as required for thermal expansion and to ensure a continuous sill gutter to handle infiltrated water. The sill channel shall provide for exterior weepage through ¼" diameter weep holes located at approximately 6" on each side of the vertical mullions. The framing system shall provide for flush glazing on all sides with no projecting stops.

F. GLASS

Install 1" insulating glass "clear" as per section 08800 glass and lazing. Glass to be tempered in doors and sidelites.

PART 3 - EXECUTION

A. INSTALLATION

All glass framing shall be set in correct locations as shown in the details and shall be level, square, plumb and in alignment with the other work in accordance with the manufacturer's installation instructions and approved shop drawings. All joints between framing and the building structure shall be sealed in order to secure a watertight installation.

Upon completion of the installation of the entrances, it shall be this contractor's responsibility to make all necessary final adjustments to attain normal operation of each door and its mechanical hardware.

B. PROTECTION, CLEANING, AND FINAL ADJUSTMENTS

After installation, the Contractor shall adequately protect exposed portions of aluminum surfaces from damage by grinding and polishing compounds, plaster, lime, acid, cement, or other contaminants. Provide final cleaning of the windows system prior to final acceptance.

END OF SECTION

STATE OF UTAH
UTAH NATIONAL GUARD
OGDEN ARMORY-ROOFING IMPROVEMENTS
DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT - PROJECT NUMBER 05040470
OGDEN, UTAH

SECTION 09900 - PAINTING

PART 1 - GENERAL

A. RELATED DOCUMENTS:

1. The general provisions of the contract, including General and Supplementary conditions and General Requirements, as well as all codes and standards referenced, apply to the work specified in this section.

B. DESCRIPTION OF WORK:

1. The extent of the painting work is shown on the drawings and schedules, and as herein specified.

2. The work includes painting and finishing of interior and exterior items and surfaces throughout the project where indicated. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of the work.

3. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

4. Paint all surfaces where designated in "schedules", except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Architect will select these from standard colors available for the materials systems specified.

C. RELATED WORK NOT INCLUDED:

(a) Shop Priming
(b) Prefinished Items
(c) Concealed Surfaces
(d) Operating Parts and Labels

D. SAMPLES:

a. Submit samples for Architect's review of color and texture only. Compliance with all other requirements is the exclusive responsibility of the contractor. Provide a listing of the material and application for each coat of each finish sample.

E. DELIVERY AND STORAGE:

1. Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information:

a. Name or title of material.

b. Federal Specification number, if applicable.
c. Manufacturer's stock number and date of manufacture.
d. Manufacturer's name.
e. Contents by volume, for major pigment and vehicle constituents.
f. Thinning instructions.
g. Application instruction.
h. Color name and number.

F. JOB CONDITIONS:

1. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

2. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperature are between 45 degree F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

3. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

4. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

A. COLORS AND FINISHES:

1. Paint colors, surface treatments, and finishes, are to be selected by the Architect. For purposes of bidding (2) standardized colors which will be matched and maintained throughout project.

2. Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrate. Upon request from other trades, furnish information on characteristics of finish materials used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify the Architect in writing of any anticipated problems using specified coating systems with substrate primed by others.

B. PAINT SYSTEMS:

1. Refer to **Paint Schedule** at the end of this section.

PART 3 - EXECUTION

A. INSPECTION:

1. Applicator must examine the areas and conditions under which painting work is to be applied and notify the contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the applicator.

    a. Starting of painting work will be construed as the Applicator's acceptance of the surfaces and conditions within any particular area.

    b. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

2. Do not proceed with succeeding coat of paint until previous coat has been inspected by Architect.

B. SURFACE PREPARATION:

1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition. Remove all hardware, hardware accessories, machined surfaces, plated lighting fixtures, and similar items in place and not to be finish painted prior to surface preparation and painting operations. Following completion of paint of each space or area, reinstall the removed items by workmen skilled in the trades involved.

2. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly painted surfaces.

    a. Cementitious Materials: Prepare cementitious surfaces of concrete, concrete block, brick, cement plaster and cement-asbestos board to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

        (1) Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted in the manufacturer's printed directions.

        (2) Clean concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner.

        (3) Flush floor with clean water to neutralize acid, and allow to dry before painting.

3. Wood: Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

4. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

5. Galvanized Surfaces: Clean free of oil and surface contaminants with a non-petroleum based solvent which is compatible with coating system and pretreatment.

C. MATERIAL PREPARATION:

1. Mix and prepare painting materials in accordance with manufacturer's directions:

   a. Store materials not used in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign material and residue.

2. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film if necessary, strain the material before using.

D. APPLICATION:

1. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the substrate and type of material being applied.

2. Apply additions coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

3. Paint surfaces behind moveable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation.

4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

5. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated.

6. Sand lightly between each succeeding enamel or varnish coat.

7. Omit the first coat (primer) on metal surfaces which have been shop-primed and tough-up painted, unless otherwise indicated.

8. Apply the first-cost material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

9. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried in accordance to the manufacturers recommendations listed with the paint. The

application of another coat of paint must not cause lifting or loss of adhesion of the undercoat.

10. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

11. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of Laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

12. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

E. MINIMUM COATING THICKNESS:

1. Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness of not less than four (4) mils.

F. CLEAN-UP AND PROTECTION:

1. Clean-up: During the progress of the work, remove from the site all discarded paint materials, rubbish, and rags at the end of each work day. Maintain empty paint containers on site until project is complete. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing scraping, using care not to scratch or otherwise damage finished surfaces.

2. Protection: Protect work by other trades, whether to be painted or not, against damage by painting and finishing work. Correct ant damage by cleaning, repairing or replacing, and repainting, as acceptable by the Architect.

    a. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

    b. At the completion of work of other trades, touch-up and restored all damaged or defaced painted surfaces.

PAINT SCHEDULE

The following paint systems as identified by "ICI Dulux Paints" code number shall indicate a minimum standard of acceptable quality, but is not intended to indicate those materials to be proprietary. Equivalent coating systems by Ameritone, Pratt and Lambert, Glidden and Sherwin Williams, are approved; however, submit exact list of proposed products for Architect's approval. Where not approved, use original item specified.

Note: Refer to Architectural Drawings and Details for locations of areas to be painted.

EXTERIOR COATINGS

Ferrous Metal

Primer:	4160-XXXX	Devguard Multi Purpose Tank and Structural Primer (spot prime as needed)
First Coat:	4216-XXXX	Lifemaster-Pro High Performance Waterborne Acrylic Semi-Gloss Enamel
Second Coat:	4216-XXXX	Lifemaster-Pro High Performance Waterborne Acrylic Semi-Gloss Enamel

Galvanized Metal

Primer:	CPC 05-255-PP	Metal Prime
Second Coat	CPC 01-242	Exterior 100% Acrylic Semi-Gloss
Third Coat	CPC 01-242	Exterior 100% Acrylic Semi-Gloss

TPO Metal

The TPO metal shall be painted as per the roofing manufacturers and/or TPO metal manufacturers requirements. The paint color shall be selected at a later date.

END OF SECTION

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 15.

B. This section applies to all Division 15 specification sections.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
   1. Submittals.
   2. Coordination drawings.
   3. Record documents.
   4. Rough-ins.
   5. Mechanical installations.
   6. Cutting and patching.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 15, plus general related specifications including:
      a. Access to mechanical installations.

1.3 GOVERNING REGULATIONS AND AUTHORITIES

A. Regulations include laws, ordinances, codes, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the work, govern the execution of the work embodied in the contract documents, and the interpretation of the contract documents.

B. Applicable codes and documents to this project are, but not limited to, the following:
   1. 2003 International Building Code - (with Utah amendments)
   2. 2003 International Mechanical Code - (with Utah amendments)
   3. 2003 International Plumbing Code - (with Utah amendments)
   4. 2003 International Energy Conservation Code.
   5. National Electrical Code - current edition

1.4 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS", and as outlined below.
   1. By description, catalog number and manufacturer's name standards of quality have been established for certain manufactured equipment items and specialties which are to be furnished by this Division. Substitute products of equal or better quality may only be proposed for use if specifically named in the specifications or

given written approval prior to bidding. Requests for substitution shall be made in accordance with the General Provisions.

2. Within 45 days after the date of award of contract, and before commencement of work, a complete schedule of all equipment and materials proposed for installation shall be submitted.
3. Submittal data for Division 15 shall be submitted arranged in a three-ring binder. Binder shall have a complete index with equipment listed in the same sequence as the sections in the specifications. Identify the equipment submitted with drawings, schedule number, and specification paragraph number.
4. Submittals shall include, but not be limited to the following:
   a. Scheduled Equipment Items
   b. Vibration Elimination Devices
   c. Seismic Restraint System
   d. Valves
   e. Insulation
   f. Registers, Grilles, and Diffusers
   g. Roof Drains
   h. Certificates of Guarantee
5. Description of equipment shall include sizes, capacities, operating characteristics, brand names, motor horsepowers, accessories, materials gauges, manufacturer's maintenance instructions and other pertinent information required to establish quality of the products. List on the front of catalogs the page number referring to submitted items. Underline applicable data on the indicated pages. Where proposed equipment size varies from equipment first named, Contractor shall specifically call Architect's attention to that fact in writing at the time of submission of data.
6. All submittal data shall be turned over to the Architect at one time. No consideration will be given to partial submittals.
7. After engineering review, the Contractor may proceed to place an order for such item of equipment. However, actual fabrication by manufacturer may not commence until complete and accurate shop drawings have been submitted to Architect and have received his reviewed stamp and signature.
8. A copy of the complete contract specification for the item, including motor requirements and any specific details of construction, shown on the drawings shall be sent to the factory furnishing such item, at the time the order is placed to avoid unnecessary errors.
9. The Contractor should protect himself with the supplier of alternate named equipment. Should Contractor submit on any item of equipment other than first named equipment in the specification and if alternate equipment is rejected or disapproved by the Architect for any of the reasons stated above, the Contractor shall be required to resubmit on first named equipment.
10. All items other than first named specified equipment shall show and state all exceptions and deviations taken and shall include design calculations.
11. The Contractor shall review the submittals prior to submission to make sure that submittals are complete in all details. Contractor shall verify equipment dimensions to fit the spaces provided with sufficient clearance for servicing the equipment. Submittals will not be reviewed which do not bear the Contractor's notation that such checking has been made.
12. Equipment submittal shall show the proper arrangements to suit installation and maintenance such as motor location, access doors, filter removal, piping connections, etc.
13. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment.
14. Review and acceptance of submittal does not relieve the Contractor of responsibility for fulfilling the contract requirements. Review of the submittal shall not change the contract requirements. Items not covered in the accepted

submittal or items incorrectly covered but not recognized or identified shall not be used contrary to the contract documents.

15. Verify electrical characteristics of all equipment with Division 16 before ordering any equipment.

B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus one copy of each submittal required, which will be retained by the Mechanical Consulting Engineer.
   1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.
   2. Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.
   3. Product Data: 1 additional copy of each item.

C. Additional copies may be required by individual sections of these Specifications.

1.5 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Division 1 Section "COORDINATION," to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
      a. Clearances for installing and maintaining insulation.
      b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      c. Equipment connections and support details.
   2. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   3. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.6 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "CONTRACT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:
   1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
   2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
   3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.8 WARRANTIES

A. In addition to guarantee specified in General Conditions, guarantee heating and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

B. That the circulation of water or glycol shall be complete and even.

C. That all pipes, conduit, and connections shall be free from foreign matter and pockets and that all other obstructions to the free passage of water, liquid and vent shall be removed.

D. That all devices incorporated in these systems shall be adjusted in a manner that each shall develop its maximum efficiency in the operation of the system.

E. All equipment and the complete system shall be guaranteed for a period of one year from the date of Substantial Completion. The Contractor shall be responsible for a 100-percent guarantee for the system and all items of equipment for this period.

F. Any failure that disables a heating or cooling system shall have repairs completed within 24 hours. If repair parts are not available in local stock, they shall be shipped via air freight at no charge to the owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Arrange equipment with factory panels, conduits, piping, etc. to allow proper access to equipment. Comply with clearances required by the National Electric Code.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate mechanical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Install systems, materials, and equipment to conform with manufacturers installation instructions and approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
10. Provide and install access panel or doors where mechanical devices such as valves, dampers, fire dampers, etc. are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS AND FRAMES."
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
12. Completely clean all mechanical equipment and systems of dirt, dust, debris and overspray at the time of substantial completion.
13. All factory-authorized equipment start-ups shall be witnessed by the Owner's representative, unless written exception is given. Any equipment start-ups completed without Owner's representative being present shall be repeated.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
   1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover Work to provide for installation of ill-timed Work.
   2. Remove and replace defective Work.
   3. Remove and replace Work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed Work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
    a. Refer to Division 1 Section "DEFINITIONS AND STANDARDS" for definition of "experienced Installer."
2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.
    a. Refer to Division 1 Section "DEFINITIONS AND STANDARDS" for definition of "experienced Installer."

END OF SECTION 15010

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. This section applies to all Division 15 specification sections.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Escutcheons.
   3. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
   4. Field-fabricated metal and wood equipment supports.
   5. Installation requirements common to equipment specification sections.
   6. Mechanical demolition.
   7. Cutting and patching.
   8. Touchup painting and finishing.
   9. Accessibility.

B. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces, mechanical equipment rooms and utility tunnels.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic.
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. NP: Nylon plastic.
   4. PE: Polyethylene plastic.
   5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. CR: Chlorosulfonated polyethylene synthetic rubber.
   2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

B. Welder Certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

1.5 COORDINATION DRAWINGS

A. General: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Have coordination drawings available at job site for coordination. Include the following:
   1. Planned piping layout, including valve and specialty locations and valve-stem movement.
   2. Clearances for installing and maintaining insulation.
   3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
   4. Equipment and accessory service connections and support details.
   5. Sizes and location of required concrete pads and bases.
   6. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
   7. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   8. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.
   9. Planned duct systems layout, including elbow radii and duct accessories.
   10. Access panel and door locations.

1.6 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

C. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code -- Steel."

D. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

F. Coordinate connection of electrical services.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. All pipe and pipe fittings shall be American made and clearly labeled as such.

B. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.

C. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32.
1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.

2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

C. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.
a. Finish: Polished chrome-plate.
4. Cast Brass: Split casting, with concealed hinge and set screw.
a. Finish: Polished chrome-plate.
5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Stamped Steel: One piece, with spring clips and chrome-plated finish.
7. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
9. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
11. Cast-Iron Floor Plate: One-piece casting.

2.4 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing,

and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping close to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
   1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
   2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
   3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
   4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
   5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

Q. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."

4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

R. Piping Connections: Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to manufacturers written instructions and approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors.

3.3 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:
1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.

4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.5 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.6 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 15 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Removal: Remove indicated equipment from Project site.

E. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.7 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.8 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 15050

SECTION 15055 - MOTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes basic requirements for motors. It includes motors that are factory-installed as part of equipment and appliances as well as field-installed motors.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70, "National Electrical Code."

B. NRTL Listing: Provide NRTL listed motors.
   1. Term "Listed": As defined in "National Electrical Code," Article 100.
   2. Listing Agency Qualifications: "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Comply with NEMA MG 1, "Motors and Generators."

D. Comply with UL 1004, "Motors, Electric."

PART 2 - PRODUCTS

2.1 MOTORS, GENERAL

A. General: Requirements below apply to motors covered by this Section except as otherwise indicated.

B. Normally motors larger than 1/2 HP: Polyphase.

C. Normally motors 1/2 HP and smaller: Single-phase.

D. Frequency Rating: 60 Hz.

E. Voltage Rating: Determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages):
   1. 120 V Circuit: 115 V - motor rating.
   2. 208 V Circuit: 200 V - motor rating.
   3. 240 V Circuit: 230 V - motor rating.
   4. 480 V Circuit: 460 V - motor rating.

F. Service factors indicated for motors are minimum values and apply at frequency and utilization voltage at which motor is connected. Provide motors which will operate in service factor range when supply voltage is within 10 percent of motor voltage rating.

G. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100 percent of rated capacity. Provide NEMA torque curve for each motor provided and included in O & M manual.

H. Temperature Rise: Based on 40 deg C ambient except as otherwise indicated.

I. Enclosure: Open dripproof, unless otherwise specified or indicated.

2.2 POLYPHASE MOTORS

A. General: Squirrel-cage induction-type conforming to the following requirements except as otherwise indicated.

B. NEMA Design Letter Designation: "B."

C. Multi-Speed Motors: Separate winding for each speed.

D. Energy Efficient Motors: Nominal efficiency equal to or greater than that stated in NEMA MG 1, table 12-6C for that type and rating of motor.

E. Internal Thermal Overload Protection For Motors: For motors so indicated, protection automatically opens control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to the temperature rating of the motor insulation.

F. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading of the application.

G. Rugged Duty Motors: Totally enclosed with 1.25 minimum service factor. Provide motors with regreasable bearings and equipped with capped relief vents. Insulate windings with nonhygroscopic material. External finish shall be chemical resistant paint over corrosion resistant primer. Provide integral condensate drains.

H. Motors for Reduced Inrush Starting: Coordinate with indicated reduced inrush controller type and with characteristics of driven equipment load. Provide required wiring leads in motor terminal box to suit control method.

2.3 SINGLE-PHASE MOTORS

A. General: Conform to the following requirements except as otherwise indicated.

B. Energy Efficient Motors: One of the following types as selected to suit the starting torque and other requirements of the specific motor application.
1. Permanent Split Capacitor.
2. Split-Phase Start, Capacitor-Run.
3. Capacitor-Start, Capacitor-Run.

C. Shaded-Pole Motors: Use only for motors smaller than 1/20 hp.

D. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens the power supply circuit to the motor, or a control circuit arranged for external connection. Protection operates when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Provide device that

automatically resets when motor temperature returns to normal range except as otherwise indicated.

E. Bearings, belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single phase motors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: The following requirements apply to field-installed motors.

B. Install motors in accordance with manufacturer's published instructions and the following:
1. Direct Connected Motors: Mount securely in accurate alignment.
2. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts identified by the manufacturer and tension belts in accordance with manufacturer recommendations.

3.2 COMMISSIONING

A. Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part.

B. Report unusual conditions.

C. Correct deficiencies of field-installed units.

END OF SECTION 15055

SECTION 15060 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

B. Related Sections include the following:
1. Division 15 Section "Mechanical Vibration and Seismic Controls" for vibration isolation and seismic restraint devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design seismic restraint hangers and supports for piping and equipment.

B. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:
   a. AAA Technology and Specialties Co., Inc.
   b. B-Line Systems, Inc.
   c. Carpenter & Patterson, Inc.
   d. Empire Tool & Manufacturing Co., Inc.
   e. Globe Pipe Hanger Products, Inc.
   f. Grinnell Corp.
   g. GS Metals Corp.
   h. Michigan Hanger Co., Inc.
   i. National Pipe Hanger Corp.
   j. PHD Manufacturing, Inc.
   k. PHS Industries, Inc.
   l. Piping Technology & Products, Inc.

2. Channel Support Systems:
   a. B-Line Systems, Inc.
   b. Grinnell Corp.; Power-Strut Unit.
   c. GS Metals Corp.
   d. Michigan Hanger Co., Inc.; O-Strut Div.
   e. National Pipe Hanger Corp.
   f. Thomas & Betts Corp.
   g. Unistrut Corp.
   h. Wesanco, Inc.

3. Thermal-Hanger Shield Inserts:
   a. Carpenter & Patterson, Inc.
   b. Michigan Hanger Co., Inc.
   c. PHS Industries, Inc.
   d. Pipe Shields, Inc.
   e. Rilco Manufacturing Co., Inc.
   f. Value Engineered Products, Inc.

4. Powder-Actuated Fastener Systems:
   a. Gunnebo Fastening Corp.
   b. Hilti, Inc.
   c. ITW Ramset/Red Head.
   d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
   1. Coatings: Galvanized, Metallic.
   2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
   1. Coatings: Galvanized, Metallic.

2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

D. Rooftop Support Systems: Factory-fabricated components consisting of rubber support base and 12 gage or 14 gage Channel.
1. Supports complete with channel mounted on base or adjustable height angle supported from threaded rods attached to the base.
2. Manufactured units by B-line; Series C, CB, CS or CE.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

D. Rooftop Piping Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install pre-manufactured rooftop piping support systems.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (675 kg).
    c. Heavy (MSS Type 33): 3000 lb (1350 kg).
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
1. Field assemble and install according to manufacturer's written instructions.

C. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

D. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

E. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

J. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.9.
   2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
      b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   5. Insert Material: Length at least as long as protective shield.
   6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15071 - MECHANICAL VIBRATION AND SEISMIC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. This section is part of each Division-15 section making reference to seismic and vibration control products specified herein.

1.2 SEISMIC AND VIBRATION CONTROL

A. General: Division 15 shall be responsible for purchasing and installing vibration isolators, flexible connections, rigid steel frames, concrete inertia bases, anchors, inserts, hangers and attachments and seismic bracing and snubbers as required for seismic control and prevention of the transmission of vibration for both isolated and non-isolated systems.

B. All mechanical equipment shall be designed for the site specific Seismic Zone as per the International Building Code.

C. Reference Standards: The work shall comply to the following standards:
1. International Building Code, current edition
2. NFPA Bulletin 90A, current edition
3. Bridge Bearing Specifications

D. Design Parameters: Refer to Section 1621 of the 2003 International Building Code and ASCE 7-02.

E. Approved Manufacturers:
1. In order to insure that the requirements of the project are achieved, the Contractor must secure the services of a manufacturer or supplier who has proven capabilities of dealing effectively with vibration characteristics, effects and criteria and can provide facilities and capabilities for measuring, evaluating and designing for seismic disturbances.
2. Manufacturers approved for use are:
   a. Mason Industries, Inc.
   b. Amber/Booth Company.
   c. Vibration Eliminator Co.
3. The Manufacturer's responsibilities shall include designing and providing all vibration isolators and seismic restraints. He shall also be responsible for the proper installation of these components. Periodic inspections to the job site will be made as required. He shall make a final inspection and submit a report to the Architect certifying compliance to these specifications, drawings and related standards. Provide submittals as specified.
4. The Manufacturer's responsibilities shall include designing and providing all vibration isolators and seismic restraints. He shall also be responsible for the proper installation of these components. Periodic inspections to the job site will be made as required. The professional engineer who performs the calculations shall make a final inspection and submit a report to the Architect certifying compliance to these specifications, drawings and related standards. The Owner shall be notified in advance when the seismic engineer will be performing final

certification inspection. The Owner may wish to be present for this inspection. Provide submittals as specified.

F. Submittals: Submittal data prior to fabrication, shall include but not be limited to the following:
1. Complete engineering calculations and shop drawings for all vibration and seismic requirements for all equipment, piping and ductwork.
2. The Utah State professional stamp of the Engineer who is responsible for the design and operation of the Vibration and Seismic System.
3. The type, size, and deflection of each isolator proposed for items in this specification and on the drawings.
4. Details for all the isolators and seismic bracing with snubbers proposed for items in this specification and on the drawings.
5. Details for steel frames and concrete inertia bases to be used in conjunction with the isolation and seismic restraint of the items in this specification and drawings.
6. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing and snubber.
7. The size, loading and location of pipe and duct supports with an as-built plan or complete description of the system.

G. Vibration Isolation:
1. All mechanical equipment 1 HP, and over unless otherwise noted, shall be isolated from the structure by means of resilient vibration and noise isolators designed and supplied by the Seismic and Vibration Control Manufacturer. Piping and ductwork connected to vibrating equipment shall be isolated from the structure as required to prevent vibration transmission. Isolation equipment, hangers, connections, and other isolating devices shall be designed and installed to prevent transmission of vibration to the structure from the mechanical equipment or any of the associated piping and ductwork.
2. All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases unless the equipment manufacturer certified direct attachment capability. The steel frames and bases on isolated equipment shall be provided by the Seismic and Vibration Control Manufacturer.

H. Vibration isolators shall be provided as follows and as otherwise indicated:
1. Roof mounted air handlers shall be mounted on spring isolated roof curbs.
2. Isolate all ductwork that is connected to vibration isolated equipment, for a distance of at least 50 feet from the equipment. Isolators shall be Type D spring hangers with neoprene elements.

I. Vibration isolators shall be as follows:
1. Type D Spring Hangers: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Hangers shall be type 30N as manufactured by Mason Industries, Inc. or equal by Amber-Booth.
2. Type P Neoprene Pad: A pad type mounting consisting of two layers of 3/8" thick ribbed or waffled bridge bearing neoprene pads bonded to a 16 gage galvanized steel separator plate. Anchor bolt with neoprene washer and sleeve.

J. Seismic Restraints:
1. General: The intent of the seismic restraints is to restrain the mechanical equipment, pipes and ducts during an earthquake for life safety purposes; to

prevent equipment from overturning; to prevent suspended equipment, pipes and ducts from swaying or falling and creating a potential life safety hazard. For "Essential" and "Hazardous" facilities (as defined in the International Building Code), the intent of the seismic restraint system also includes keeping the mechanical systems operational during and following an earthquake. See Section 05500 "Metal Fabrication" for standards for miscellaneous metal fabrication.

2. The following mechanical items shall be seismically braced as specified, detailed on the drawings, or as recommended by the Seismic and Vibration Control manufacturer:
   a. Packaged Rooftop Air Handlers - anchor bolts
   b. All duct work and piping shall be provided with seismic restraints in accordance with the current edition of the International Building Code. Insulated piping longitudinal restraints shall be attached directly to piping.
3. Connections of the seismic bracing to the structure shall be coordinated with the General Contractor and acceptable to the Structural Engineers. In general, connect to beams, concrete slabs, or to the top member of the joists at the panel points. Division 15 shall provide spanner beams where required for seismic bracing. Seismic anchorage shall extend through concrete house keeping pads and anchor to the building floor slabs.
4. The Seismic and Vibration Control manufacturer shall determine the number, size, and type of anchor bolts, cable restraints, seismic snubbers, etc., for each piece of equipment and groups of pipes and ducts. Individual pipes and ducts shall be braced as per the SMACNA details and approved and verified by the Seismic and Vibration Control manufacturer.

K. Seismic Snubbers:
1. All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases as described in the vibration control specifications unless the equipment manufacturer certifies direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. The snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4" thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" nor more than 1/4". Snubbers shall be installed with factory set clearances.
2. The capacity of the seismic snubber at 3/8" deflection shall be 3 to 4 times the load assigned to the mount grouping in its immediate area. Submittals shall include load deflection curves up to 1/2" deflection in the y and z planes. Test shall be conducted in an independent laboratory or under the signed supervision of an independent registered engineer. The snubber assemblies shall be bolted to the test machine as the snubber is normally installed. Test reports shall certify that neither the neoprene elements nor the snubber body sustained any obvious deformation after release of load. Snubbers shall be series Z-1011 as manufactured by Mason Industries, Inc. or equal by Amber-Booth.

END OF SECTION 15071

SECTION 15080 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe insulation.

B. Related Sections: The following sections contain requirements that relate to this section:
1. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 DEFINITIONS

A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.

B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.

C. Cold Surfaces: Normal operating temperatures less than 75 deg F.

D. Thermal Resistivity: "r-values" represent the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between two exposed faces required to cause one Btu to flow through one square foot of material, in one hour, at a given mean temperature.

E. Density: Is expressed in lb/sq.ft.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.

C. Material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

1.5 QUALITY ASSURANCE

A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.

2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

1.6 SEQUENCING AND SCHEDULING

A. Schedule insulation application after testing of piping and duct systems.

B. Schedule insulation application after installation and testing of heat trace tape.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Glass Fiber:
   a. CertainTeed Corporation.
   b. Knauf Fiberglass GmbH.
   c. Manson.
   d. Owens-Corning Fiberglas Corporation.
   e. John Manville.
   f. USG Interiors, Inc. - Thermafiber Division.

2.2 GLASS FIBER

A. Material: Inorganic glass fibers, bonded with a thermosetting resin.

B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

C. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.
1. Thermal Conductivity: 0.25 average maximum at 75 deg F mean temperature.
2. Density: 10 pcf average maximum.

D. Adhesive: Produced under the UL Classification and Follow-up service.
1. Type: Non-flammable, solvent-based.
2. Service Temperature Range: Minus 20 to 180 deg F.

E. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.3 INSULATING CEMENTS

A. Mineral Fiber: ASTM C 195.
1. Thermal Conductivity: 1.0 average maximum at 500 deg F mean temperature.
2. Compressive Strength: 10 psi at 5 percent deformation.

B. Expanded or Exfoliated Vermiculite: ASTM C 196.
1. Thermal Conductivity: 1.10 average maximum at 500 deg F mean temperature.
2. Compressive Strength: 5 psi at 5 percent deformation.

C. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement: ASTM C 449.
1. Thermal Conductivity: 1.2 average maximum at 400 deg F mean temperature.

2. Compressive Strength: 100 psi at 5 percent deformation.

2.4 ADHESIVES

A. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:
1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.
2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2.5 JACKETS

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
1. Water Vapor Permeance: 0.02 perm maximum, when tested according to ASTM E 96.
2. Puncture Resistance: 50 beach units minimum, when tested according to ASTM D 781.

C. PVC Jacketing: High-impact, ultra-violet-resistant PVC, 20-mils thick, roll stock ready for shop or field cutting and forming to indicated sizes.
1. Adhesive: As recommended by insulation manufacturer.
2. Color:
a. Color as selected by Architect in all areas except tunnels and equipment rooms.
b. In Equipment Rooms, color matching backgroud identification color as specified in Section 15075 (ASME 13).

D. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultra-violet-resistant PVC.
1. Adhesive: As recommended by insulation manufacturer.
2. Color:
a. Color as selected by Architect in all areas except tunnels and equipment rooms.
b. In Equipment Rooms, color matching backgroud identification color as specified in Section 15075 (ASME 13).

2.6 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.
1. Tape Width: 4 inches.
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: 3/4-inch wide, in one of the following materials compatible with jacket:
1. Stainless Steel: Type 304, 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Aluminum: 0.007 inch thick.
4. Brass: 0.01 inch thick.
5. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 14-gage nickel copper alloy, 16-gage, soft-annealed stainless steel, or 16-gage, soft-annealed galvanized steel.

2.7 SEALING COMPOUNDS

A. Vapor Barrier Compound: Water-based, fire-resistive composition.
   1. Water Vapor Permeance: 0.08 perm maximum.
   2. Temperature Range: Minus 20 to 180 deg F.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.
   1. Follow cement manufacturer's printed instructions for mixing and portions.

3.2 INSTALLATION, GENERAL

A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.

B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.

C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.

D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

E. Install insulation with smooth, straight, and even surfaces.

F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

H. Seal Ends: Taper ends at 45 degree angle and seal with lagging adhesive.

I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.

J. Keep insulation materials dry during application and finishing.

K. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:
   1. Vibration control devices.
   2. Testing laboratory labels and stamps.
   3. Nameplates and data plates.
   4. Access panels and doors in air distribution systems.

5. Factory insulated equipment.

3.3 PIPE INSULATION INSTALLATION, GENERAL

A. Tightly butt longitudinal seams and end joints. Bond with adhesive.

B. Stagger joints on double layers of insulation.

C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.

D. Apply insulation with a minimum number of joints.

E. Apply insulation with integral jackets as follows:
1. Pull jacket tight and smooth.
2. Cover circumferential joints with butt strips, at least 3-inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.
3. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
   a. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F.
4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
6. Repair damaged insulation jackets. Adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.

F. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.

G. Exterior Wall Penetrations: For penetrations of below grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor barrier coating.

H. Fittings, Valves, and Roof Drain Bowls - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, fittings, and roof drain bowls. Make joints tight. Bond with adhesive.
1. Use same material and thickness as adjacent pipe insulation.
2. Overlap nesting insulation by 2 inches or 1-pipe diameter, which ever is greater.
3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
4. Insulate elbows and tees smaller than 3-inches pipe size with premolded insulation.
5. Insulate elbows and tees 3 inches and larger with premolded insulation or insulation material segments. Use at least 3 segments for each elbow.

6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.

I. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified in Division 15 Section "Hangers and Supports." For cold surface piping, extend insulation on anchor legs a minimum of 12 inches and taper and seal insulation ends.
   1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.4 GLASS FIBER PIPE INSULATION INSTALLATION

A. Bond insulation to pipe with lagging adhesive.

B. Seal exposed ends with lagging adhesive.

C. Seal seams and joints with vapor barrier compound.

3.5 JACKETS

A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch laps at longitudinal joints and 3-inch-wide butt strips at end joints.
   1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.

B. Interior Exposed Insulation: Install continuous PVC jackets.

C. Install the PVC jacket with 1-inch overlap at longitudinal and butt joints and seal with adhesive.

3.6 FINISHES

A. Paint finished insulation (except colored PVC jacket) as specified in Division 9 Section "Painting."

3.7 APPLICATIONS

A. General: Materials and thicknesses are specified in schedules at the end of this Section.

B. Interior Piping Systems: Unless otherwise indicated, insulate the following piping systems:
   1. Storm water. Insulate roof drain bodies and all storm water piping.

3.8 PIPE INSULATION SCHEDULES

A. General: Abbreviations used in the following schedules include:
   1. Field-Applied Jackets: P - PVC, K - Foil and Paper, A - Aluminum, SS - Stainless Steel, C - Glass Cloth.
   2. Pipe Sizes: NPS - Nominal Pipe Size.
   3. All system piping shall be thermally insulated in accordance with ASHRAE 90.1-99, table 6.2.4.5.

INTERIOR STORM WATER

(≤ Less than or Equal to) (>Greater than)

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD-APPLIED JACKET
≤1-1/2	GLASS FIBER	1	YES	CONCEALED (NONE) EXPOSED (A)(P)(C)
>1-1/2	GLASS FIBER	1	YES	CONCEALED (NONE) EXPOSED (A)(P)(C)

END OF SECTION 15080

SECTION 15411 - PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing piping systems to a point 5 feet outside the building. Systems include the following:
   1. Storm Drainage systems.

B. Related Sections: The following sections contain requirements that relate to this Section:
   1. Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and installation requirements not specified in this Section.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working pressure ratings, except where indicated otherwise:
   1. Storm Drainage Systems: 10-foot head of water.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1.5 COORDINATION DRAWINGS

A. Coordination drawings, drawn accurately to scale and coordinating penetrations. Do not submit. Prepare drawings and retain at job site for coordination.

1.6 QUALITY ASSURANCE

A. Comply with the provisions of ASME B31.9 "Building Services Piping" for materials, products, and installation.

B. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

A. General: The application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems are indicated in Part 3 Article "Pipe and Fittings Applications."

B. Hubless, Cast-Iron Soil Pipe: CISPI 301 ATSM A-888.

2.2 PIPE FITTINGS AND TUBE FITTINGS

A. Hubless, Cast-Iron Soil Pipe Fittings: CISPI 301.

2.3 JOINING MATERIALS

A. Cast-Iron Soil Pipe and Fittings: ASTM C 564 neoprene rubber gaskets and lubricant.

B. CISPI Couplings for Hubless Cast-Iron Soil Pipe and Fittings: CISPI 310, having ASTM C 564 neoprene sealing sleeve, with 300 Series stainless-steel corrugated shield-and-clamp assembly.

PART 3 - EXECUTION

3.1 PIPE AND FITTINGS APPLICATIONS

A. General: Use pipe, tube, fittings, and joining methods for piping systems according to the following applications.

B. Storm Drainage Piping Above Ground: Use the following:
1. Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, CISPI-type couplings for hubless cast-iron soil pipe and fittings, and hubless joints.

3.2 PIPING INSTALLATION, GENERAL

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

3.3 DRAINAGE PIPING INSTALLATION

A. Install cast-iron soil pipe and cast-iron soil pipe fittings according to CISPI 1990 revised and edited edition of "Cast Iron Soil Pipe and Fittings Handbook, Volume I," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

B. Make changes in direction for drainage and vent piping using appropriate Y branches, Y branches with 1/8 bends, and long-sweep 1/4, 1/5, 1/6, 1/8, and 1/16 bends. Reduction of the size of drainage piping in the direction of flow is prohibited.

C. Install drainage and vent piping at the following minimum slopes, except where another slope is indicated:
1. Horizontal Storm Drainage Piping: 1/8 inch per foot (1 percent).

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Cast-Iron Soil Pipe and Cast-Iron Soil Pipe Fitting Joints: Make joints according to recommendations in CISPI 1990 revised and edited edition of "Cast Iron Soil Pipe and Fittings Handbook, Volume I," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Hubless Joint: Make with neoprene gasket and sleeve or clamp.

3.5 HANGERS AND SUPPORTS INSTALLATION

A. Hanger and support devices are specified in Division 15 Section "Hangers and Supports."

B. Install hangers for horizontal piping with following maximum spacing and minimum rod sizes:

Nom. Pipe Size (Inches)	Steel Pipe Max. Span (Feet)	Copper Tube Max. Span (Feet)	Min. Rod Diameter (Inches)
2	12	12	3/8
2-1/2	12	12	1/2
3	12	12	1/2
3-1/2	12	12	1/2
4	12	12	5/8, 1/2 for copper
5	12	12	5/8, 1/2 for copper
6	12	12	3/4, 5/8 for copper

C. Pipe Attachments: Install the following:
   1. Adjustable Steel Clevis Hangers: MSS Type 1 for individual straight horizontal runs 100 feet and less.

D. Support cast-iron soil pipe and fittings not included in table, at maximum horizontal spacing of 5 feet, except 10-foot sections of pipe may be supported at 10-foot spacing and at maximum vertical spacing of 15 feet.

3.6 FIELD QUALITY CONTROL

A. Inspect drainage piping as follows:
   1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
   2. During progress of installation, notify the plumbing official having jurisdiction at least 24 hours prior to time such inspection must be made. Perform tests specified below in presence of the plumbing official.
      a. Roughing-In Inspection: Arrange for inspection of piping system after system roughing-in, before concealing, and prior to setting fixtures.
      b. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.
   3. Reinspections: Make required corrections and arrange for reinspection by plumbing official when piping system fails to pass test or inspection.
   4. Reports: Prepare inspection reports signed by the plumbing official.

B. Drainage and Vent Piping System Tests: Test drainage and vent systems according to procedures of authority having jurisdiction or, in absence of published procedure, as follows:
   1. Test for leaks and defects in new drainage and vent piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
   2. Leave uncovered and unconcealed in new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose for testing work that has been covered or concealed before it has been tested and approved.

3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open-jointed drain tile, test piping of plumbing drainage and venting systems on completion of roughing-in piping installation. Tightly close all openings in piping system and fill with water to point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
4. Repair leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping system. Remove dirt and debris as work progresses.

3.8 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or when work stops.

C. Exposed ABS or PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of a water-based latex paint.

END OF SECTION 15411

SECTION 15430 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing specialties for storm drainage systems.

B. Related Sections: The following sections contain requirements that relate to this Section:
1. Division 15 Section "Basic Mechanical Materials and Methods" for piping-joining materials, joint construction, basic installation requirements, and labeling and identifying requirements.
2. Division 15 Section "Plumbing Piping" for piping and connections.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working pressure ratings, except where otherwise indicated:
1. Storm Drainage Systems: 10-foot head of water.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Submit product data including rated capacities of selected models and weights (shipping, installation, and operation). Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following plumbing specialty products:
1. Roof drains.

1.5 QUALITY ASSURANCE

A. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

B. Listing and Labeling: Provide equipment that is listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Roof Drains:
   a. Jones Manufacturing Co., Inc.
   b. Josam Co.
   c. Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
   d. Wade Div., Tyler Pipe.
   e. Watts.
   f. Zurn by Hydromechanics Div., Zurn Industries, Inc.

2.2 MISCELLANEOUS PIPING SPECIALTIES

A. Piping specialties such as escutcheons, dielectric fittings, sleeves, and sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

2.3 ROOF DRAINS

A. General: Size outlet as indicated on drawings.

2.4 FLASHING MATERIALS

A. Lead: ASTM B 749, Type L51121, copper-bearing sheet, at least 4 psf (0.0625-inch thick) for general use, and at least 6 psf (0.0937-inch thick) for burning (welding), except as otherwise indicated.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units as required for installation; matching or compatible with material being installed.

D. Bituminous Coating: SSPC-12, solvent type, bituminous mastic.

PART 3 - EXECUTION

3.1 ROOF DRAIN INSTALLATION

A. Install roof drains at low points of roof areas, according to the roof membrane manufacturer's installation instructions.

B. Install drain flashing collar or flange so no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

C. Position roof drains for easy accessibility and maintenance.

3.2 FLASHING INSTALLATION

A. Provide flashing manufactured in a single piece except where large pans, sumps, or other drainage shapes are required.

B. Install 4-psf lead flashing except when another weight or material is specified.

C. Install 6-psf lead flashing or heavier where burning (welding) of lead sheets is required.

D. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with membrane waterproofing.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum sleeve length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

E. Set flashing on floors and roofs in solid coating of bituminous cement.

F. Secure flashing into sleeve and specialty clamping ring or device.

G. Extend flashing up vent pipe passing through roofs and secure flashing into cast-iron sleeve having calking recess.

H. Fabricate and install lead sheet flashing and pans, sumps, and other drainage shapes as indicated. Install drain connection when indicated. Provide 36" X 36" 4-psf lead flashing at each roof drain.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or when work stops.

3.4 PLUMBING SPECIALTY DATA SHEETS

A. Roof Drains
   1. Primary Roof Drain: Smith figure 1010-ERC cast iron body with combined flashing clamp and cast iron gravel stop, cast iron dome, extension, sump receiver and underdeck clamp.
   2. Secondary Roof Drain: Smith figure 1080-ERC cast iron body with flashing clamp, gravel stop, cast iron dome, 2" high cast iron water collar, extension, sump receiver and underdeck clamp.

END OF SECTION 15430

SECTION 15732 - ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following rooftop air conditioners:

1. Cooling-only units 6 tons (21 kW) and smaller.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:

1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that rooftop air conditioners, accessories, and components will withstand seismic forces defined in Division 15 Section "Mechanical Vibration and Seismic Controls." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For rooftop air conditioners to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

F. ARI Certification: Units shall be ARI certified and listed.

G. ARI Compliance for Units with Capacities Less Than 135,000 Btuh (39.6 kW): Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

1.6 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

B. Coordinate size, location, and installation of rooftop air-conditioner manufacturer's roof curbs and equipment supports with roof installer.

1. Coordinate installation of restrained vibration isolation roof-curb rails.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
3. Warranty Period for Electronic Thermostats: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-drive fan.
2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 ROOFTOP AIR CONDITIONERS 6 TONS (21 kW) AND SMALLER

A. Manufacturers:

1. Addison Products Company.
2. Carrier Corp.
3. Lennox Industries Inc.
4. McQuay International.
5. Skymark International, Inc.
6. Trane Company (The); North American Commercial Group.
7. YORK International Corporation.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

C. Casing: Steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch- (13-mm-) thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

D. Indoor Fan: Forward curved, centrifugal, belt driven by single-speed motor.

E. Outside Coil Fan: Propeller type, directly driven by motor.

F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

G. Compressor: Hermetic reciprocating compressor with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief**,** and crankcase heater.

H. Refrigeration System:

1. Compressor.
2. Outside coil and fan.
3. Indoor coil and fan.
4. Four-way reversing valve and suction line accumulator.
5. Expansion valve with replaceable thermostatic element.
6. Refrigerant dryer.
7. High-pressure switch.
8. Low-pressure switch.
9. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
10. Low-ambient switch.
11. Brass service valves installed in discharge and liquid lines.
12. Charge of refrigerant.

I. Filters: **2-inch- (50-mm-),** fiberglass, pleated**,** throwaway filters in filter rack.

J. Outside-Air Damper: Linked damper blades, for 0 to 25 percent outside air, with manual slide and fully modulating, spring-return damper motor and hood.

K. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.

1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses to adjust mixing dampers.
3. Relief Damper: Gravity actuated with bird screen and hood.

L. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

M. Unit Controls: Solid-state control board and components contain at least the following features:

1. Indoor fan on/off delay.
2. Default control to ensure proper operation after power interruption.
3. Service relay output.
4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.
6. Defrost control.
7. Economizer control.
8. Indoor-air quality control with carbon dioxide sensor.
9. Low-ambient control, allowing operation down to 0 deg F (minus 18 deg C).
10. Minimum run time.
11. Night setback mode.
12. Return-air temperature limit.
13. Smoke alarm with smoke detector installed in supply and return air.

14. Low-refrigerant pressure control.
15. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

N. Thermostat: Programmable, electronic; with cooling setup with seven-day programming; and the following:

1. Touch sensitive keyboard.
2. Automatic switching.
3. Deg F readout.
4. LED indicators.
5. Hour/day programming.
6. Manual override capability.
7. Time and operational mode readout.
8. Status indicator.
9. Battery backup.
10. Subbase with manual system switch (on-heat-auto-cool) and fan switch (auto-on).
11. Fan-proving switch to lock out unit if fan fails.
12. Dirty-filter switch.

O. Optional Accessories:
1. Condensate drain trap.
2. Dirty-filter switch.
3. Coil guards of painted, galvanized-steel wire.
4. Power exhaust fan.

P. Roof Curb: Steel with corrosion-protection coating, gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of **24 inches (600 mm**.

2.3 MOTORS

A. Comply with requirements in Division 15 Section "Motors."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances.

B. Curb Support: Install roof curb on roof structure, level and secure. Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction.

C. Isolation Curb Support: Install units on isolation curbs according to ARI Guideline B.

3.2 CONNECTIONS

A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
1. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 15 Section "Duct Accessories."

B. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners.

END OF SECTION 15732

SECTION 15815 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 15 Sections apply to this section:
1. "Basic Mechanical Requirements."
2. "Basic Mechanical Materials and Methods."

1.2 SUMMARY

A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air conditioning systems in pressure classes from minus 2 inches to plus 10 inches water gage.

B. Related Sections: The following sections contain requirements that relate to this Section:
1. Division 7 Section "Joint Sealant" for fire-resistant sealants for use around duct penetrations and fire damper installations in fire rated floors, partitions, and walls.
2. Division 8 Section "Access Doors and Frames" for wall- and ceiling-mounted access panels and doors for access to concealed ducts.
3. Division 15 Section "Mechanical Insulation" for exterior duct and plenum insulation.
4. Division 15 Section "Duct Accessories" for flexible duct materials, dampers, duct-mounted access panels and doors, and turning vanes.
5. Division 15 Section "Testing, Adjusting, and Balancing."

1.3 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:
1. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
2. Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Duct shop drawings and duct work coordination drawings shall not be submitted to the architect, but shall be available at the job site for coordination, with the exception of exposed ducts in finished areas. Submit shop drawings to Architect showing exposed ducts in all finished areas.

C. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:
   1. Duct Liner.
   2. Sealing Materials.

D. Shop drawings from duct fabrication shop, drawn to a scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as the Contract Drawings, detailing:
   1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
   2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust ducts systems, indicate the classification of the materials handled as defined in this Section.
   3. Fittings.
   4. Reinforcing details and spacing.
   5. Seam and joint construction details.
   6. Penetrations through fire-rated and other partitions.
   7. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

E. Coordination drawings for ductwork installation in accordance with Division 15 Section "Basic Mechanical Requirements." In addition to the requirements specified in "Basic Mechanical Requirements" show the following:
   1. Coordination with ceiling suspension members.
   2. Special coordination with other systems installed in the same space with the duct systems.
   3. Coordination of ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
   4. Coordination with ceiling-mounted lighting fixtures and air outlets and inlets.

F. Welding certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying with requirements specified in "Quality Assurance" below.

G. Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices, in accordance with Division 15 Section "Basic Mechanical Requirements" and Division 1.

H. Maintenance data for volume control devices, fire dampers, and smoke dampers, in accordance with Division 15 Section "Basic Mechanical Requirements."

1.6 QUALITY ASSURANCE

A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code."

B. Qualify each welder in accordance with AWS qualification tests for welding processes involved. Certify that their qualification is current.

C. NFPA Compliance: Comply with the following NFPA Standards:
   1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.
   2. NFPA 96, "Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors for Commercial Cooking Equipment," Chapter 3, "Duct System," for kitchen hood duct systems, except as indicated otherwise.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle sealant fire-stopping materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Deliver and store stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Store duct liner to protect from moisture. Wet duct liner, even though dried, must be replaced with new material. No exceptions.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Sheet Metal, General: Provide sheet metal in thicknesses indicated (minimum 26 gauge), packaged and marked as specified in ASTM A 700.

B. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.

C. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts provide reinforcing of compatible materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DUCT LINER

A. General: Comply with NFPA Standard 90A and TIMA Standard AHC-101.

B. Materials: ASTM C 1071, Type II, fiberglass duct liner with acrylic coated surface exposed to airstream to prevent erosion of glass fibers and treated with EPA registered anti-microbial agent proven to resist microbial growth as determined by ASTM G21 and G22.
   1. Thickness: 1 inch.
   2. Density: 2 pounds.

3. Thermal Performance: "K-Factor" equal to 0.28 or better, at a mean temperature of 75 deg F, ASTM C 518.
4. Noise Reduction Coefficient: 0.55 or higher based on "Type A Mounting" and tested in accordance to ASTM C 423. (1.5 pcf, 1" thickness)
5. Fire Hazard Classification: Flame spread rating of not more than 25 without evidence of continued progressive combustion and a smoke developed rating of no higher than 50, when tested in accordance with ASTM C 411.
6. Liner Adhesive: Comply with NFPA Standard 90A and ASTM C 916.
7. Maximum Velocity: 5,000 ft./min.
8. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer, that do not cause leakage in the duct, and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.
    a. Fastener Pin Length: As required for thickness of insulation, and without projecting more than 1/8 inch into the airstream.
    b. Adhesive For Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.

2.3 SEALING MATERIALS

A. Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics.

B. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with the tape to form a hard, durable, airtight seal.

C. Joint and Seam Sealant: One-part, nonsag, solvent- release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 75 percent solids.

D. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.4 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.

B. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.
1. Hangers Installed In Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped- galvanized rods with threads painted after installation.
2. Straps and Rod Sizes: Conform with Tables 4-1, 4-1M, and 4-2 in SMACNA "HVAC Duct Construction Standards," 1995 Edition, for sheet steel width and gage and steel rod diameters.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.
1. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.

2.5 RECTANGULAR DUCT FABRICATION

A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Tables 1-3 through 1-25, including their associated details. Conform to the requirements in the referenced standard for metal thickness (minimum 26 gauge), reinforcing types and intervals, tie rod applications, and joint types and intervals.
   1. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
   2. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
   3. All rectangular low pressure supply air, transfer air, relief air, and return air ducts shall be acoustically lined on the inside with 1" thick duct liner unless otherwise noted. All elbows and fittings shall be insulated. Exterior ducts shall be lined with 2" duct liner. Exhaust air ducts are not to be lined unless otherwise noted.

B. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard," Figure 1-8.

2.6 RECTANGULAR DUCT FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Duct Construction Standard," 1995 Edition, Figures 2-1 through 2-18.
   1. Elbows:
      a. Type RE-1 radius elbow with 1-1/2 W radius.
      b. Type RE-2 square throat elbow with single thickness turning vanes.
      c. Type RE-5 dual radius elbow.

2.7 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited.

B. Apply a coat of adhesive to transverse and longitudinal liner edges.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping.

E. Longitudinal joints in rectangular ducts shall not occur except at corners of ducts, unless the size of the duct and standard liner product dimensions make longitudinal joints necessary.
   1. Apply an adhesive coating on longitudinal seams.

F. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely around perimeter; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

G. Secure transversely oriented liner edges facing the airstream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:

1. Fan discharge.
2. Intervals of lined duct preceding unlined duct.

H. Terminate liner with duct buildouts installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to the duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire damper sleeve through fire separation.

2.8 ROUND AND FLAT OVAL DUCT FABRICATION

A. General: "Basic Round Diameter" as used in this article is the diameter of the size of round duct that has a circumference equal to the perimeter of a given sized of flat oval duct. Except where interrupted by fittings, provide round and flat oval ducts in lengths not less than 12 feet.

B. Round Ducts: Fabricate round supply ducts with spiral lockseam construction, except where diameters exceed 72 inches. Fabricate ducts having diameters greater than 72 inches with longitudinal butt-welded seams. Comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Table 3-2 for galvanized steel gages(minimum 26 gauge).

C. Flat Oval Ducts: Fabricate flat oval supply ducts with standard spiral lockseams or with butt-welded longitudinal seams in gages (minimum 26 gauge) listed in SMACNA "HVAC Duct Construction Standards," 1995 Edition, Table 3-4.

D. Single Wall Lined Ducts: All interior exposed low pressure supply air round ducts and fittings shall be double wall or lined with 1" thick duct liner unless noted otherwise.
1. Install the duct liner in accordance with the manufacturer's recommendations.

2.9 ROUND AND FLAT OVAL SUPPLY AND EXHAUST FITTINGS FABRICATION

A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figures 3-4 to 3-6 and with metal thicknesses (minimum 26 gauge) specified for longitudinal seam straight duct.
1. Tees: 90^{o} tee with oval to round tap. Conical tees.

B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.

C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:
1. Mitered Elbows: Fabricate mitered elbows with welded construction in gages specified below.
a. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Table 3-1.
b. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:
1) 3 to 26 inches: 24 gage.
c. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from 2 inches to 10 inches:
1) 3 to 14 inches: 24 gage.

d. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B; and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with a single-thickness turning vanes.

2. Round Elbows - 8 Inches and Smaller: Die-formed or stamped elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 3-1/2- and 4-1/2-inch) elbows with gored or segmented construction.
3. Round Elbows - 9 Through 14 Inches: Gored or segmented or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 9-1/2- and 10-1/2-inch) elbows with gored or segmented construction.
4. Die-Formed or Stamped Elbows for Sizes Through 8 Inches and All Pressures: 20 gage with 2-piece welded construction.
5. Round Gored or Segmented Elbows Gages: Same as for nonelbow fittings specified above.
6. Flat Oval Elbows Gages: Same as longitudinal seam flat oval duct.
7. Pleated Elbows Sizes Through 14 Inches and Pressures Through 10 Inches: 26 gage.

D. Single Wall Lined Ducts: All interior exposed low pressure supply air round ducts and fittings shall be double wall or lined with 1" thick duct liner unless noted otherwise.
1. Install the duct liner in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.
1. High pressure supply duct between fan unit and terminal boxes: 6 inches w.g. positive.
2. Low pressure supply duct between fan units and room outlets: 3 inches w.g. positive.
3. Low pressure supply duct between terminal boxes and room outlets: 1 inch w.g. positive.

B. Install ducts with the fewest possible joints.

C. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.

D. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

E. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.

H. Install insulated ducts with 1-inch clearance outside of insulation.

I. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.

J. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

K. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

M. Protect lined duct from moisture. Wet duct liner, even though dried, must be replaced. No exceptions.

N. Interior of ducts shall be kept clean. Protect ducts from dust, dirt, debris, etc., by covering exposed ends of ducts during storage and construction. Ducts which become dirty shall be cleaned to satisfaction of the Engineer and Owner.

3.2 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints as follows:

B. Pressure Classification 2 and 3 Inches Water Gage: All transverse joints and longitudinal seams and duct penetrations.

C. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only and duct penetrations.

D. Seal externally insulated ducts prior to insulation installation.

E. Ducts exposed to view shall have tape sealer in a neat manner. Paint tape sealer on unpainted ducts to match duct.

3.3 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," 1995 Edition, Tables 4-1 through 4-3 and Figures 4-1 through 4-9.

B. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.

C. Support vertical ducts at a maximum interval of 16 feet and at each floor.

D. Upper attachments to structures shall have an allowable load not exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated.

E. Install concrete insert prior to placing concrete.

F. Install powder actuated concrete fasteners after concrete is placed and completely cured.

G. Steel roof deck shall not be used to support loads from ductwork or equipment, unless noted otherwise.

H. Ducts exposed to view shall be supported using threaded rod or some other method that is neat in appearance. Straps are not an acceptable method of hanging ducts that are exposed to view.

I. Seismic bracing for ducts exposed to view must be neat in appearance. Proposed method shall be submitted to the Architect prior to duct installation.

3.4 CONNECTIONS

A. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 15 Section "Duct Accessories."

B. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figures 2-5 and 2-6.

C. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figures 2-14 through 2-17.

D. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," 1995 Edition, Figure 2-17.

3.5 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing, and as required for compliance with test requirements.

B. Conduct tests, in the presence of the Architect or Owner's representative, at static pressures equal to the maximum design pressure of the system or the section being tested. If pressure classifications are not indicated, test entire system at the maximum system design pressure. Do not pressurize systems above the maximum design operating pressure. Check duct system for audible leaks. Give 7 days' advanced notice for testing.

C. Maximum Allowable Leakage: As described in ASHRAE 1997 Handbook, "Fundamentals" Volume, Chapter 32, Table 6 and Figure 14. Comply with requirements for leakage classification 3 for round and flat oval ducts, leakage classification 12 for rectangular ducts in pressure classifications less than and equal to 2 inches water gage (both positive and negative pressures), and leakage classification 6 for pressure classifications greater than 2 inches water gage and less than and equal to 10 inches water gage.

D. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage.

E. Leakage Test: Perform volumetric measurements and adjust air systems as described in ASHRAE 1995 "HVAC Systems and Applications" Volume, Chapter 34 and ASHRAE 1997 "Fundamentals" Volume, Chapter 14, and Division 15 Section "TESTING, ADJUSTING, AND BALANCING."

3.6 ADJUSTING AND CLEANING

A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 15 Section "TESTING, ADJUSTING, AND BALANCING" for requirements and procedures for adjusting and balancing air systems.

B. Vacuum ducts systems prior to final acceptance to remove dust and debris.

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Backdraft dampers.
   2. Manual volume control dampers.
   3. Actuators.
   4. Turning vanes.
   5. Duct-mounted access doors and panels.
   6. Flexible connectors.
   7. Accessories hardware.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 8 Section "Access Doors and Frames" for ceiling- and wall-mounted access panels and doors.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:
   1. Backdraft dampers.
   2. Manual volume control dampers.
   3. Duct-mounted access panels and doors.

C. Shop drawings from manufacturer detailing assemblies. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail the following:
   1. Special fittings and volume control damper installation (both manual and automatic) details.

D. Product Certification: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static pressure loss, and dimensions and weights.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA Standards:
   1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
   2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 BACKDRAFT DAMPERS

A. Description: Suitable for horizontal or vertical installation.

B. Frame: 18-gage galvanized steel, with welded corners, or 0.063-inch-thick 6063T extruded aluminum.

C. Blades: 0.025-inch-thick roll-formed aluminum, or 0.050-inch-thick 6063T extruded aluminum.

D. Blade Seals: Vinyl or neoprene.

E. Blade Axles: Nonferrous or galvanized steel.

F. Tie Bars and Brackets: Aluminum or galvanized steel.

G. Return Spring: Adjustable tension.

H. Chain Operator: 15-foot-long galvanized-steel sash chain and pulley.

I. Wing-Nut Operator: Galvanized steel, with 1/4-inch galvanized-steel rod.

2.2 MANUAL VOLUME CONTROL DAMPERS

A. General: Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability under operating conditions. Provide locking device to hold dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Provide end bearings or other seals for ducts with pressure classifications of 3 inches or higher. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft.

B. Standard Volume Control Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.
   1. Steel Frames: Hat-shaped, galvanized-steel channels, minimum of 16 gage, and with mitered and welded corners. Provide frames with flanges where indicated for attaching to walls. Provide flangeless frames where indicated for installation in ducts.
   2. Roll-Formed Steel Blades: 16-gage galvanized steel.
   3. Blade Axles: Galvanized steel.
   4. Tie Bars and Brackets: Galvanized steel.

C. Jackshaft: 1-inch-diameter, galvanized-steel pipe rotating within a pipe bearing assembly mounted on supports at each mullion and at each end of multiple damper assemblies. Provide appropriate length and number of mounting to connect linkage of each damper of a multiple damper assembly.

D. Damper Control Hardware: Zinc-plated, die-cast core with a heavy-gage dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Provide center hole to suit damper operating rod size. Provide elevated platform for insulated duct mounting. Provide gasketing to reduce air leakage.

2.3 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Refer to the Access Door Materials Schedule at the end of this Section for frame and door thickness, number of hinges and locks, and location of locks. Provide construction and airtightness suitable for duct pressure class.

B. Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.

C. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide 1-inch by 1-inch butt hinge or piano hinge and cam latches.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.

E. Insulation: 1-inch thick fiber glass or polystyrene foam board.

F. Size: 12" X 12" minimum size or 2" narrower X 12" for duct 24" wide or narrower. 18" X 18" minimum size for duct larger than 24".

2.4 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.

B. Metal-Edged Connectors: Factory-fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 24-gage, galvanized sheet steel or 0.032-gage aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.

C. Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.
   1. Minimum Weight: 26 oz. per sq yd.
   2. Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.

2.5 ACCESSORIES HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide in length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket, 1/4-inch, zinc-plated operating rod, and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.

B. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Provide duct-mounted access doors as required for access at each fire damper, smoke damper, combination fire/smoke damper and ceiling fire damper, motorized control damper.

3.3 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Final positioning of manual dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

ACCESS DOOR MATERIALS SCHEDULE

DUCT PRESSURE CLASS	DOOR SIZE INCHES	NUMBER OF HINGES	NUMBER OF LOCKS	METAL GAGE FRAME	METAL GAGE DOOR	METAL GAGE BACK
2 INCHES & LESS	12X12	2	1-S	24	26	26
	16X20	2	2-S	22	24	26
	24X24	3	2-S	22	22	26
3 INCHES	12X12	2	1-S	22	22	26
	16X20	2	1-S,1-T,1-B	20	20	26
	24X24	3	2-S,1-T,1-B	20	20	24
4 TO 10 INCHES	12X12	2	1-S,1-T,1-B	20	20	26
	16X20	3	2-S,1-T,1-B	20	18	24
	24X24	3	2-S,2-T,2-B	18	18	24

S: SIDE
T: TOP
B: BOTTOM

END OF SECTION 15820

SECTION 15850 - AIR HANDLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 15 Sections apply to this section:
1. "Basic Mechanical Requirements."
2. "Basic Mechanical Materials and Methods."

1.2 SUMMARY

A. This Section includes the following types of air-handling units:
1. Centrifugal roof ventilators

B. Related Sections: The following sections contain requirements that relate to this section:
1. Division 7 Section "Roof Accessories" for roof curbs and equipment supports.
2. Division 15 Section "Air Handling" for package units that include fans.
3. Division 15 Section "Controls" for control sequence descriptions.
4. Division 15 Section "Testing, Adjusting, and Balancing" for air-handling systems testing, adjusting, and balancing requirements and procedures.
5. Division 15 Section "Motors."
6. Division 16 Section "Motor and Circuit Disconnects" for disconnect switches.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
1. Product data for selected models, including specialties, accessories, and the following:
a. Certified fan performance curves with system operating conditions indicated.
b. Certified fan sound power ratings.
c. Motor ratings and electrical characteristics plus motor and fan accessories.
d. Materials gages and finishes, including color charts.
e. Dampers, including housings, linkages, and operators.
2. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
3. Coordination drawings, in accordance with Division 15 Section "Basic Mechanical Requirements," for fan room layouts, roof penetration requirements, and reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:
a. Roof framing and support members relative to duct penetrations.
b. Method of attaching hangers to building structure.
c. Size and location of initial access modules for acoustical tile.
d. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

4. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
5. Product certificates, signed by manufacturers of air-handling units, certifying that their products comply with specified requirements.
6. Maintenance data for air-handling units, for inclusion in Operating and Maintenance Manual.

1.4 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."

B. UL Compliance: Fans and components shall be UL listed and labeled. Fans serving kitchen hoods and dishwasher hoods shall be UL listed for the removal of smoke and grease laden vapors.

C. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Lift and support units with the manufacturer's designated lifting or supporting points.

B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

C. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad.

B. Coordinate the installation of roof curbs, equipment supports, and roof penetrations.

C. Coordinate the size and location of structural steel support members.

1.7 EXTRA MATERIALS

A. Furnish one additional complete set of belts for each belt-driven fan.

B. Provide one drive change if required to meet installed conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Centrifugal Roof Ventilators:
   a. ACME.
   b. Ammerman Company, Inc.
   c. Carnes Company, Inc.
   d. Central Blower Co.
   e. Cincinnati Fan & Ventilator Co.
   f. Cook (Loren) Co.
   g. Essick Air Products, Breidert.
   h. Greenheck Fan Corp.
   i. ILG Industries, Inc.
   j. Jenn Industries, Inc.
   k. Penn Ventilator.
   l. Quietaire Corp.

2.2 SOURCE QUALITY CONTROL

A. Testing Requirements: The following factory tests are required:
   1. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
   2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

2.3 FANS, GENERAL

A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.

B. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.
   1. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.

C. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
   1. Service Factor: 1.4.

D. Belts: Oil-resistant, nonsparking, and nonstatic.

E. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 HP; fixed pitch for use with motors larger than 15 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
   1. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.

F. Shaft Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA L(50)) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

G. Factory Finish: The following finishes are required:
   1. Sheet Metal Parts: Prime coating prior to final assembly.
   2. Exterior Surfaces: Baked-enamel finish coat after assembly.

2.4 CENTRIFUGAL ROOF VENTILATORS

A. General Description: Belt-driven or direct-drive as indicated, centrifugal consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged, aluminum base with venturi inlet cone.
   1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to the housing, with the following features:
   1. Pulleys: Cast-iron, adjustable-pitch.
   2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   3. Fan Shaft: Turned, ground, and polished steel drive shaft keyed to wheel hub.
   4. Fan motor isolated from exhaust air stream.

E. Accessories: The following items are required as indicated:
   1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
   2. Bird Screens: Removable 1/2-inch mesh, 16-gage, aluminum or brass wire.
   3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops, motor-operated, parallel-blade, volume control dampers mounted in curb base, as indicated.
      a. Blades: Die-formed sheet aluminum.
      b. Frame: Extruded aluminum, with waterproof, felt blade seals.
      c. Linkage: Nonferrous metals, connecting blades to counter weight or operator.
      d. Operators: Manufacturer's standard electric motor.
   4. Roof Curbs: Prefabricated, heavy-gage, galvanized steel; mitered and welded corners; 2-inch-thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2-inch wood nailer. Size as required to suit roof opening and fan base.
      a. Overall Height: 12 inches.

2.5 MOTORS

A. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.

B. Motor Sizes: Minimum sizes and electrical characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.

C. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).

D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.

E. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design B. Provide permanent-split capacitor classification motors for shaft-mounted fans and capacitor start classification for belted fans.
   1. Bases: Adjustable.
   2. Bearings: The following features are required:
      a. Ball or roller bearings with inner and outer shaft seals.
      b. Grease lubricated.
      c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
   3. Enclosure Type: The following features are required:
      a. Open dripproof motors where satisfactorily housed or remotely located during operation.
      b. Guarded dripproof motors where exposed to contact by employees or building occupants.
   4. Overload protection: Built-in, automatic reset, thermal overload protection.
   5. Noise rating: Quiet.
   6. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112, Test Method B.
   7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.
   8. Motors used with a variable frequency drive shall be compatible with the VFD manufacturer and shall be NEMA Standard MG-1 Part 31, definite purpose inverter fed polyphase.

F. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 16.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, housekeeping pads, and other conditions affecting performance of fans.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as described below, using the vibration control devices indicated. Vibration control devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."
   1. Secure roof-mounted fans to roof curbs with cadmium-plated hardware and install roof curbs.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Wire and connect motorized backdraft dampers.

3.3 CONNECTIONS

A. Duct installations and connections are specified in other Division 15 sections. Make final duct connections with flexible connections.

B. Electrical Connections: The following requirements apply:
1. Electrical power wiring is specified in Division 16.
2. Temperature control wiring and interlock wiring are specified in Division 15 Section "Automatic Temperature Controls."
3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Inspection: Arrange and pay for a factory-authorized service representative to perform the following:
1. Inspect the field assembly of components and installation of fans including ductwork and electrical connections.
2. Prepare a written report on findings and recommended corrective actions.

3.5 ADJUSTING, CLEANING, AND PROTECTING

A. Adjust damper linkages for proper damper operation.

B. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.6 COMMISSIONING

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
1. Remove shipping blocking and bracing.
2. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
6. Verify manual and automatic volume control and that fire and smoke dampers in connected ductwork systems are in the full-open position.
7. Disable automatic temperature control operators.

B. Starting procedures for fans:
1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
a. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.

C. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

3.7 DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:
   1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
   2. Familiarization with contents of Operating and Maintenance Manuals.

B. Schedule training with at least 7 days' advance notice.

END OF SECTION 15850

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING; MECHANICAL O&M MANUALS; AND SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Related sections include the following:
1. Division 15 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.
2. Division 15 system sections specifying leak testing requirements and procedures.

1.2 SYSTEM AIR BALANCE & TESTING

A. Division 15 shall be responsible for the mechanical system balancing and manuals and shall include in his bid the cost of a Professional Balancing Firm to do the work as outlined. The balancing work shall be under the direction of a Professional Engineer, NEBB--certified TAB supervisor--or AABC--certified TAB supervisor--with experience in balancing systems of similar types and size. Approved balancing companies are Quality Balancing Co., BTC Services, Diamond Test and Balance, Certified Testing & Balancing, RS Analysis, and Bonneville Test & Balance Company.

B. The balancing work shall include but not be limited to the following:
1. All system air balance work and reports.

C. The HVAC Sheet Metal Installer & Control Installer are to provide men to assist with problems related to the air and water balance and atrium smoke control system test. The Balancing Firm shall provide all other manpower required to accomplish the balancing work.

D. Professional Balancing Firm shall furnish all necessary tools, scaffolding and ladders that are required and shall provide all required instruments, record all readings and see that any necessary adjustments are made.

E. Instruments shall be used and applied which are best suited to the system function being tested. Instruments shall be in first class state of repair and will have calibration certified prior to starting the job. Instruments shall be recalibrated during the balancing process if required to prove reliability.

F. Provide a suitable single line drawing for each fan system. Large fan systems may be broken into suitable zones. Drawings shall be on 8-1/2" X 11" sheets of graph paper with system and zone heading the sheet. Drawings may be free hand but must be neat and legible.

G. For each system locate on the drawing each main duct damper and each branch duct damper.

H. Identify each main duct, branch duct, and air outlet by number or letter, together with its required CFM.

I. Prepare test report sheets coordinated with contract drawings and zone sketch.

J. Make sure that all calculations and tests are based only on complete equipment data and on approved drawings.

K. After all adjustments are made, a detailed written report shall be prepared and submitted for approval. Final acceptance will not be made until a satisfactory report is received and field verified.

L. The Owner's representative will field verify the report in the following manner:
1. Select points to be tested at random. (Quantity shall not exceed 10% of total.)
2. Require Balancing firm to read the quantities in his presence.

M. Air Balancing Procedures:
1. Before any adjustments are made, the systems are to be checked for such items as dirty filters, duct leakage, damper leakage, equipment vibrations, correct damper operation, etc. All fan systems, major duct sections, registers, diffusers, etc., are to be adjusted to deliver design air quantities with plus or minus 10%. Individual air outlets, when one of three or more serve a space, may have a tolerance of 15% above average. Design CFM is based on filters being approximately 50% loaded with dirt. Pressure drop across filters during balancing shall be simulated to that condition. After balancing is completed, check motor amperage with the filters clean.
2. Distribution system shall be adjusted to obtain uniform space temperatures free from objectionable drafts and noise within the capabilities of the system.
3. Sheaves and/or belts shall be exchanged as required to adjust the rpm of all fans so they handle specified air quantity.

N. Miscellaneous:
1. All installed thermal overload protection shall be observed and noted in the data sheets. If the starter equipment is incorrect, such information shall be tabulated, including required size thermal overloads, and included in the report. If thermal overload protection is incorrect, it shall be the responsibility of the balancing firm to notify in writing the Contractor and Architect so that proper overload protection is installed.
2. The adjusting crew shall measure and set any special conditions such as minimum outside air quantities; check and adjust outside and return air intakes so that the system will deliver substantially the same volume on either; make test and record data as required in "REPORT."
3. All balancing devices, i.e., dampers and valves, shall be clearly marked as to the final balanced position. Plug all test holes, replace access doors and belt guards.

4. When deemed necessary by the Architect or Engineer, 24 hour space temperature recording shall be taken and any required partial rebalance of the system shall be performed without additional cost. If adjustments are required to produce other than design requirements shown on drawings because of job conditions, these adjustments shall be made without extra cost.
5. The balancing contractor shall be responsible to set the correct flow at all variable volume and constant volume valves.

O. Report:
1. A bound report shall be provided in the Operation and Maintenance Manual which shall contain a general information sheet listing instruments used, method of balancing, altitude correction, and manufacturer's grille, register and diffuser data.
2. Provide equipment data sheets listing make, size, serial number, rating, etc., of all mechanical equipment, including fans, pumps, motors, starters and drives. Operating data shall include rotational speed, inlet and outlet pressures, pressure drop across filters, coils and other system components, pump heads and measured motor current and voltage.
3. Balancing data sheets shall indicate the required and actual CFM of all supply, return and exhaust outlets or inlets, and shall be totaled and summarized by systems.
4. Reports shall contain single line drawings or reduced set of contract drawings with outlets marked thereon for easy identification of the designation used in the data sheets.
5. The report shall outline any abnormal or notable conditions not covered in the above.
6. The report shall include all measurements made under the "System Checks" section.

P. System Checks as Applicable:
1. Central Air Handlers:
   a. Record room or duct thermostat setpoint. Measure room temperature at thermostat and middle of room. Measure duct temperature at control sensor.
   b. Check each fan unit with the Control Contractor. Record as applicable within 30 minute period:
      1) Outside air temperature.
      2) Supply air temperature.
      3) Return air temperature.
      4) Mixed air temperature.
      5) Cooling coil discharge temperature.
      6) Air flow CFM supply and return fans for variable volume system with volume measuring stations.
   c. Set outside and return dampers at minimum position by adjusting economizer control. Measure outside air, return air and mixed air temperatures and calculate amount of outside air (measure amount of outside air if possible). This should preferably be done with outside air above freezing. With unit outside air and return air dampers under control of discharge sensor, have Control Contractor set discharge control to a call for full cooling. (This

should not be done in freezing weather.) After 30 minutes, read and record all temperatures as required under first item above. Check to make sure outside air damper has opened wide.

d. Set discharge control on a call for full heating. After 15 minutes read and record all temperatures as required. Check to make sure outside air damper had closed or has closed to minimum.

e. Check outside air damper and heating valve to make sure they are operating in proper sequence.

f. With System in Cooling Mode, Repeat as Specified for Heating Mode:

1) Check outside air damper and heating valve to make sure they are operating in proper sequence.

2. Outside Temperature: Put outside air bulb in ice water and record instrument reading.

1.3 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Division 15 shall be responsible for the Mechanical Operation and Maintenance Manuals and shall include costs for manuals in his bid.
2. Provide five (5) copies of Operations and Maintenance Manuals to the Owner.
3. Manuals must be approved by the Architect prior to turning them over to the Owner.
4. The Manuals shall be prepared by the Balancing Contractor.

B. Binders:

1. Binders shall be hard backed for sheet size 11" X 8-1/2". Print as follows:

OPERATING & MAINTENANCE
MANUAL
FOR THE
(LIST PROJECT NAME)

(LIST PROJECT ARCHITECT) ARCHITECT
SPECTRUM ENGINEERS MECHANICAL ENGINEERS

2. Binders shall be as manufactured by Hiller Bookbinding or equal.
3. The master index sheet and each tabbed index sheet shall be AICO Gold-Line Indexes or equal.

C. The manuals shall be organized as follows:

SECTION I: Start-Up & Operation

Contractors and Vendors
General System Description
Detailed Start-Up Procedure

SECTION II: Maintenance Instructions

Heating & Ventilating
Maintenance & Lube Table

SECTION III: Balance & Test Report

Air Balance Report
Test Run Report
Equipment Data Sheets
System Checks
System Commissioning Check List

D. The master index will list all items sequentially in the manual, including Section heading, sub-headings and groups of equipment.

E. The Contractor's and Vendor's sheet will list the name, address and phone number of the Mechanical Contractor and his subcontractors. It shall also include a complete list of equipment used, with name, address and phone number of the vendor.

F. The General System Description will consist of an overall general description of the Heating, Ventilating and Air Conditioning Systems and components.

G. The Detailed Start-Up Procedure will cover the step-by-step startup procedure for each piece of mechanical equipment. It shall be coordinated with the actual equipment on the job such as switches, starters, relays, automatic controls, etc. It shall include precautions and controls that must be actuated for equipment to operate properly.

H. The Maintenance Instructions shall consist of manufacturer's maintenance instructions for each piece of mechanical equipment installed. Instructions shall include installation; instructions, complete parts lists with numbers, recommended operation instructions, wiring diagrams, trouble shooting, maintenance and lubrication instructions and name of vendor,and any other material published by the manufacturer applicable to the installed equipment shall be included.

I. The maintenance and lube table shall be a summary list of the mechanical equipment requiring lubrication. It shall show the name of the equipment location and type and frequency of lubrication.

J. The Balance and Test Reports shall be as specified in the Balance and Test Section.

K. The Equipment Data Sheets shall be provided for each motor-driven piece of equipment. Use standard form with all pertinent information provided such as rated and measured amps, volts, RPM, pressure drops, etc.

1.4 SYSTEM COMMISSIONING

A. The System Commissioning shall consist of field verifying and certifying that the mechanical system is properly installed and is fully operational.

B. Mark each item on the check list either "Complete" or "Not Applicable." Prepare Check List similar to the following list. Under "General Items," check list shall be completed for each piece of equipment such as Pump P/1, Supply Fan SF/1, Relief Fan RF/1, etc. When System Commissioning is complete submit check list and written certification to Architect. The Final Mechanical Inspection shall not be scheduled until System Commissioning check list is acceptable to the Architect.

C. Check List:

	Completed	N.A.
1. General Items:		
Bearings Lubricated	[ ]	[ ]
Rotation Correct and Free	[ ]	[ ]
Correct Size Thermal Overload Installed	[ ]	[ ]
Shipping Restraints Removed	[ ]	[ ]
Equipment Secured in Place and Seismically Braced	[ ]	[ ]
Equipment Clean and Free of Debris	[ ]	[ ]
Vibration Isolators Correctly Located with Proper Springs	[ ]	[ ]
Motors Not Overloaded	[ ]	[ ]
Equipment Nameplates Clean and Accessible	[ ]	[ ]
2. Life Safety Items:		
Systems Completely Tested and Signed Off by All Appropriate Authorities	[ ]	[ ]
Equipment Identified	[ ]	[ ]
3. Duct System:		
Ductwork Clean	[ ]	[ ]
Access Door Tightly Closed, Gasketed with Proper Hardware	[ ]	[ ]
Balancing Dampers in Place, Open and Locked with Accessible Operators	[ ]	[ ]
Minimum Allowable Duct Leakage has been Tested and Verified	[ ]	[ ]
Minimum Friction and Dynamic Loss	[ ]	[ ]
Openings in Walls & Shafts for Air Transfer	[ ]	[ ]
Insulation Completed	[ ]	[ ]

4. Fans:

Correct V-Belt Drive Installed	[ ]	[ ]
V-Belt Drive Aligned	[ ]	[ ]
Drive Screws and Keyways Tight	[ ]	[ ]
Proper Belt Tension	[ ]	[ ]
Flexible Connection Properly Installed	[ ]	[ ]
Belt Guards in Place	[ ]	[ ]
Minimum of Negative System Effect	[ ]	[ ]

5. Filters:

Clean, Specified Cells Installed	[ ]	[ ]
No Bypass Around Filters	[ ]	[ ]
Filter Gauge Installed and Calibrated	[ ]	[ ]
Spare Cells on Site	[ ]	[ ]

END OF SECTION 15950

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INDEX

DIVISION 16 - ELECTRICAL WORK

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SECTION 16000 - GENERAL PROVISIONS, ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions and Division 1 Specification Sections apply to work of this section and all other Division 16 specification sections.

B. This section applies to all Division 16 specification sections.

1.2 SUMMARY

A. This section includes general administrative and procedural requirements for electrical installations to expand the requirements of the General Conditions and Division 1 Specification Sections.

1.3 STANDARDS

A. The following industry standards are considered minimum requirements for electrical work and are made a part of the contract documents:

1. National Electrical Code, 2005 Edition (NEC)
2. Electrical Ordinances of Local Governing Authority
3. Utah State Fire Marshal's Rules and Regulations
4. International Building Code
5. International Fire Code
6. Underwriters Laboratories (UL) Standards
7. American National Standards Institute (ANSI)
8. National Electrical Manufacturer's Association (NEMA)
9. National Fire Protection Association (NFPA) Standards
10. Regulations of American Standards Association
11. Power Company rules governing installation of electrical service.

B. If any conflict occurs between these rules and the contract documents or between the plans and specifications, notify the Architect promptly in writing. Do not proceed with any work in conflict until a solution is approved in writing by the Architect.

1.4 WORKMANSHIP

A. All Electrical Work of any nature shall be performed by qualified electricians, experienced in the type of work to be performed and licensed with the State of Utah. Electricians shall show their license upon request of the Owner, Architect and/or their representatives.

1.5 FEES AND PERMITS

A. Obtain all necessary fees, permits and inspections in accordance with the General Conditions and Division 1 Specifications. Coordinate requirements with the General Contractor.

1.6 ELECTRICAL WORK INCLUDED

A. The basic contract work includes all labor, material, tools, transportation, equipment, and superintendence specified, indicated on the drawings or necessary to make a complete

installation of, but not limited to, the following:

1. Appliances, apparatus and materials not specifically noted on drawings or mentioned herein, but which are necessary to make a complete working installation of all electrical systems required for the project.

2. Hangers, anchors, sleeves, chases, supports and fittings as may be required and as indicated.

3. Complete electric service with service conduits, service conductors, main distribution panel, distribution system, branch panels and branch circuits for power and lighting with raceway system and outlet boxes.

4. Removal, reconnection and/or relocation of existing electrical service to existing rooftop equipment as required to allow installation of new roofing system, curbs, etc., as indicated on drawings, and with all equipment in proper operating condition.

5. Replacement of existing roof mounted flagpole floodlights complete with new fixture support conduit, wiring, controls, etc., as indicated on the drawings and with all equipment in proper operating condition.

6. New weatherhead masts for existing rooftop antennas complete with conduit, support structures, grounding, etc., as indicated on drawings. Communication cable will be removed and reinstalled by the Utah National Guard.

7. New receptacles with branch circuit wiring as indicated on drawings.

8. Electrical service to new heating, ventilating and air conditioning equipment.

1.7 SUBSTITUTIONS

A. Material or products specified by name of manufacturer, brand or trade name or catalogue reference will be the basis of the bid and furnished under the contract unless changed in writing by the Architect. Where two or more materials are named, the choice of these will be optional with the Contractor.

B. Submit requests for substitution in writing to the Architect with copy to Consulting Engineer, in accordance with the General Conditions.

1.8 ACCURACY OF DATA

A. Data given herein and on the drawings are as exact as could be secured, but their absolute accuracy is not guaranteed. Specifications and drawings are for the assistance and guidance of the Contractor.

B. Electrical drawings are diagrammatic, but will be followed as closely as existing building construction and the work of other contractors will permit. All deviations from the drawings required to make the Electrical Work conform to the existing building and to the work of other contractors will be made by the Contractor as approved by the Architect.

1.9 VISIT THE SITE

A. Contractors are assumed to have visited the site and thoroughly acquainted themselves with conditions affecting the proposed work. Verify existing conditions and measurements at the

building before beginning work and immediately notify the Architect of any discrepancies which may adversely affect completion of the work.

1.10 TEMPORARY POWER

A. Provide temporary power for reasonable convenience during construction in accordance with Division 1 Specifications and the General Conditions.

B. Provide GFCI Protection for all temporary power outlets.

C. Use temporary power for construction purposes only. Do not use temporary power for electric space heating, etc..

1.11 SHOP DRAWING SUBMITTALS

A. As soon as possible after contract award, submit shop drawings for review in accordance with the General Conditions and Division 1 Specifications.

B. Submit shop drawings in three ring loose-leaf binder.

C. Divide Electrical equipment into subsections of common equipment such as wiring devices, lighting fixtures, panelboards, starters, etc.. Provide a complete equipment list at the beginning of each subsection.

D. Provide manufacturers' catalogue and/or descriptive literature indicating specific model and/or catalog numbers, options, accessories and modifications for the following items:

1. Wiring Devices
2. Metering Equipment
3. Safety Switches
4. Panelboards and Switchboards
5. Motor Starters
6. Light Fixtures

E. Above list is considered minimum. Additional items may be required to be submitted for review.

F. Refer to individual Specification Sections for additional Shop Drawing Submittal requirements.

1.12 RECORD DRAWINGS

A. Provide As-Built Record Drawings in accordance with the General Conditions and Division 1 Specifications.

B. Indicate all changes made to the drawings such as changes in fixture and outlet location, changes in circuit routing and circuit numbering, etc. Include all changes by Addenda, Change Order, Supplemental Instruction or verbal instruction.

C. Refer to individual Specification Sections for additional Record Drawing requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Provide Operation and Maintenance Manuals in accordance with the General Conditions and Division 1 Specifications.

B. Include manufacturers' catalog and/or descriptive literature of equipment actually installed. Clearly indicate on literature the specific model and/or catalog numbers of equipment installed, including all options, accessories and/or modifications.

C. All copies of literature will be new, clean and clearly legible. Sheets used for shop drawing submittals with review stamp, remarks, etc., will not be acceptable.

D. Divide Electrical equipment into subsections of common equipment such as wiring devices, lighting fixtures, panelboards, starters, etc.. Provide a complete equipment list and recommended maintenance schedule at the beginning of each subsection.

E. Refer to individual Specification Sections for additional Operation and Maintenance Manual requirements.

1.14 WARRANTY

A. Provide Warranty for Electrical Work in accordance with the General Conditions and Division 1 Specifications.

B. Provide manufacturer's warranty for all equipment which the manufacturer normally provides a warranty in excess of twelve months. Refer to individual Specification Sections for extended warranty requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials and equipment for which U.L. Standards have been established, will be listed by and bear the label of Underwriters Laboratories, Inc..

B. All materials will be new and bear the manufacturer's name, trade name and catalog or model numbers. Similar items will be of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of materials will comply with all codes and be accomplished with good workmanship in the judgement of the Architect and Consulting Engineer.

3.2 COOPERATION WITH OTHER CONTRACTORS

A. Cooperate with other contractors doing work on the building as may be necessary for the proper execution of the work of various trades employed in construction of the building.

B. Refer to architectural, and mechanical drawings, for construction details, and coordinate the electrical work with that of other contractors to the end that unnecessary delays and conflicts will be avoided.

3.3 MATERIAL HANDLING

A. Use all means necessary to protect materials before, during and after installation and to protect the installed work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

3.4 CUTTING AND REPAIRING

A. Provide all required digging, cutting, etc. incidental to the Electrical Work. Make required repairs thereafter to the satisfaction of the Architect.

B. Do not cut into any major structural element, beam or column, without written approval of the Architect.

C. Install the Electrical Work to proceed with other trades in order to avoid unnecessary cutting of the construction.

3.5 CONSTRUCTION REVIEW

A. The Owner, Architect and/or Consulting Engineer will perform construction review throughout the construction of the project. The construction review does not relieve the contractor from the responsibility of providing all materials and performing the work in accordance with the Contract Documents.

B. Notify the Architect in writing, giving ample notice, at the following stages of construction and allow the Owner, Architect and/or Engineer to review the installed work.

1. When underground electrical work is complete, before backfilling.
2. When all electrical rough-in is complete, but not covered.
3. Pre-Final, upon completion of all electrical work.
4. Final, upon completion of all items noted in the Pre-Final Construction Review Report.

C. Prerequisite for Final Electrical Construction Review:

1. Electrical Engineer/Consultant must be present.
2. Electrical Contractor's job foreman must be present.
3. DFCM Representative must be present.
4. Service Disconnect and all New Panelboard Enclosures must be open.
5. Clear access must be provided to all devices and equipment.
6. All panels, disconnects, etc. must be labeled and typed panel index cards installed.
7. All light fixtures, outlets, equipment, etc., must be energized and operable.
8. Contractor must have pad and pencil to list all deficient items.
9. Make all corrections and adjustments after the Final Construction Review, not during. Items requiring correction will appear on the Final Construction Field Report.
10. Contractor must have all required keys to provide access to all panels and doors.

D. Test all systems and equipment provided and/or connected under the Contract for short circuits, ground faults, proper neutral connections and proper operation in the presence of the Owner, Architect and/or Engineer.

E. The entire construction will be installed in accordance with the contract documents and be free of mechanical and electrical defects prior to final acceptance of the work.

* END OF SECTION 16000 *

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SECTION 16060 - MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Division 2 Demolition Sections.

1.2 SCOPE

A. Remove electrical equipment and wiring systems and make required extensions and reconnections as shown on Drawings and specified herein.

B. Repair all damage resulting from demolition and extension work.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Provide new materials and equipment for patching and extending work as specified in the appropriate Specification Section for the materials and equipment involved.

B. Where materials or methods not included in the Specifications are required, provide materials and methods in accordance with normal construction industry standards and as approved by the Architect and/or Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify existing measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition indicated on the drawings is based on field observation of existing surface conditions and available existing building electrical drawings. Report discrepancies to Owner and/or Architect before disturbing existing installation.

D. All demolition and extension work is not necessarily indicated on Drawings. Include all such work without additional cost to Owner.

3.2 PREPARATION

A. Disconnect electrical systems to equipment scheduled for removal and/or relocation.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use electricians experienced in such operations.

D. Protect all existing electrical equipment to remain from damage during demolition and new construction. Survey all existing equipment prior to beginning work and document in writing any existing damage to existing equipment.

3.3 DEMOLITION

A. Coordinate with Owner for equipment and materials to be removed by Owner or salvaged by the contractor for Owner. Place salvaged equipment and materials in storage at the project site as directed by the Owner.

B. Legally dispose of all removed equipment and materials not salvaged for the Owner.

C. Remove abandoned wiring to source of supply, i.e. panelboard, circuit breaker, etc..

D. Remove accessible abandoned conduit, cables, junction boxes, etc., including above accessible ceilings. Cut conduit flush with walls and floors.

3.4 EXTENSION OF EXISTING ELECTRICAL WORK

A. Reconnect existing equipment where demolition interrupts existing branch circuits or feeders to the equipment.

B. Repair adjacent construction and finishes damaged during demolition and extension work to match surrounding surfaces.

C. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

D. Extend existing installations using materials and methods as specified for new work. Remove and replace existing installations which are not compatible with new work.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide new typed circuit directory showing revised circuiting arrangement.

3.6 INSTALLATION

A. Install relocated materials and equipment as required for new materials and equipment.

3.7 OUTAGES

A. Maintain Existing Electrical Systems in service until new systems are complete and ready for service. Disable systems only to make switchovers and connections. Minimize outage duration.

B. Obtain permission from Owner and/or Architect before partially or completely disabling systems in accordance with Division 1 Specification Sections.

* END OF SECTION 16060 *

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SECTION 16110 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide a complete raceway system for all wiring as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Provide minimum 3/4" trade diameter raceways for all wiring systems.

1. Minimum 1/2" trade diameter raceways may be used for remote control, signaling and power-limited circuits which meet the requirements of National Electrical Code Article 725 as allowed in other Specification Sections and/or as approved by the Architect.

B. Do not use aluminum conduit, intermediate steel conduit (IMC), BX cable, MC cable, Flexible Non-metallic Tubing, NM cable, Direct Burial Cable or any other wiring methods not allowed by this specification unless approved in writing by the Architect and/or Engineer.

2.2 ABOVEGROUND RACEWAYS

A. Provide Electrical Metallic Tubing (EMT), galvanized inside and out, for raceways not subject to permanent moisture or damage.

B. Provide Galvanized Rigid Steel Conduit (GRC) where raceways are subject to permanent moisture such as underground, or damage such as vehicular traffic, etc..

2.3 UNDERGROUND RACEWAYS

A. Provide Schedule 40 PVC electrical conduit in earth or in concrete in contact with earth.

1. Provide a separate ground wire in all PVC conduits, except main electrical service conduits.

2. Provide Galvanized Rigid Steel Conduit (GRC) for all bends greater than 22 degrees in PVC conduits.

3. Do not use PVC conduit above grade nor for penetrations through structural elements such as foundation walls, floor slabs, etc..

B. Provide Galvanized Rigid Steel Conduit (GRC) for conduit penetrations through floor slab or grade to extend minimum 12" above floor or grade.

C. Provide Galvanized Rigid Steel Conduit (GRC) for conduit penetrations through foundation walls to extend minimum 36" beyond the foundation wall.

D. Corrosion protect all galvanized rigid steel conduit (GRC) installed in earth or in concrete in contact with earth with two (2) half-lapped layers of 0.010" thick approved waterproof PVC tape equal to Scotch No. 50 or use factory PVC coated rigid steel conduit with all field joints coated after installation.

2.4 FLEXIBLE RACEWAY CONNECTIONS

A. Provide Flexible Steel Conduit for final connection to motors and other equipment subject to vibrations or movement, not to exceed 3 feet in length.

B. Provide liquid-tight flexible steel conduit outside and in wet, humid, corrosive and oily locations.

1. Provide Sunlight Resistant liquid-tight flexible steel conduit outdoors.

C. Provide a ground conductor in all flexible steel conduit.

D. Flexible Steel Conduit may be used where misalignment or cramped quarters exist only with prior approval of the Architect and/or Engineer.

E. Flexible Steel Conduit may be used to fish through existing walls and ceilings only with prior approval of the Architect and/or Engineer.

2.5 CONDUIT FITTINGS

A. Provide steel compression type or steel set screw type fittings for Electrical Metallic Tubing.

B. Provide malleable iron clamp type fittings for Flexible Steel Conduit.

C. Provide steel compression type fittings for Liquid-Tight Flexible Steel Conduit.

D. Provide threaded fittings for GRC conduit. Provide double locknuts and plastic bushing for GRC conduit terminations or provide boxes and enclosures with threaded hubs.

E. Provide liquid-tight and gas-tight conduit fittings underground using fittings and PVC cement as recommended by the conduit manufacturer.

F. Provide steel rain-tight, compression type fittings for all conduit installed outside and in wet, humid, corrosive and oily locations.

G. Provide Insulated Throat Connectors for all conduit terminations 1" diameter and smaller. Provide insulating bushings for all conduit terminations 1-1/4" diameter and larger.

H. Provide Grounding Bushings bonded to the electrical system ground:

1. On each end of all service conduits.

2. On each end of all feeder conduits in which a separate ground conductor is installed.

3. On each end of all conduits used to protect ground conductors.

4. On all conduit terminations installed in concentric or eccentric knockouts or where reducing washers have been installed.

I. Do not use cast metal or indenter type fittings. Do not use screw-in type fittings for Flexible Steel Conduit. Do not use spray (aerosol) PVC cement.

2.6 RACEWAY SEALS

A. Seal all conduit penetrations through fire rated walls, ceilings and floors with a UL classified fire barrier system [in accordance with Division 7 Specification Requirements.

B. Seal all conduit penetrations through airtight spaces and plenums with an approved mastic compound acceptable to the Architect to prevent air leakage.

2.7 ROOF PENETRATIONS

A. Provide roof jacks of suitable style and material for all conduit penetrations through roof to provide a weathertight seal in accordance with the applicable Roofing Specification Sections. Coordinate style, material and installation with the roofing contractor.

2.8 PULL BOXES

A. Provide pull boxes or conduit bodies in accessible locations where required to reduce the number of bends in the conduit run to less than 360 degrees and at points not exceeding 100 feet in long branch circuit conduit runs.

1. Indicate exact location of pull boxes and conduit bodies on the As-Built Record Drawings.

2.9 PULL STRING

A. Provide a nylon or polypropylene pull string with not less than 200 lb tensile strength in all spare conduits and conduits installed for use by others. Provide a hard cardboard tag for each raceway to indicate location of the opposite end of the raceway.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Securely support all raceways with full (2 hole) pipe straps, hangers, or ceiling trapeze directly from building structure such as roof trusses, beams, floor joists, etc., in accordance with Specification Section 16190 - Supporting Devices.

1. Do not support raceways from other electrical systems or mechanical systems.

B. Provide supports at 5'-0" on center with a minimum of two supports for each ten foot length of conduit or fraction thereof up to 6 feet.

C. Provide a support within 12" of each coupling, fitting, box, enclosure and bend.

1. Install supports at vertical to horizontal conduit bends on the upper side of the bend.

D. Provide support method for parallel conduit runs as follows:

No. of Conduits	3/4" to 1-1/4" Conduits	1-1/2" and larger Conduit
2	Full Strap, Clamp or Hanger	Mounting Channel
3 or More	Mounting Channel (Trapeze)	Mounting Channel

3.2 INSTALLATION

A. Raceway layouts on the drawings are generally diagrammatic and the exact routing of raceways will be governed by structural conditions and the work of other contractors.

B. Install raceways concealed within finished ceilings, walls and floors except where exposed raceways are specifically shown on the drawings or permitted by the Architect.

C. Install exposed raceways parallel with or perpendicular to walls and ceilings, with right angle turns consisting of symmetrical bends or conduit bodies equal to Crouse-Hinds "Condulet". Avoid all bends and offsets where possible.

1. Paint exposed raceways to match surrounding surfaces in accordance with Division 9 Specification Sections, except raceways in existing Boiler Room will not be required to be painted.

D. Install raceways minimum 12" from insulation of hot water piping, steam piping and other systems or equipment with temperatures in excess of 104^0 F (40^0 C).

E. Make all field bends and offsets with a radius not less than allowed by the National Electrical Code for the type of raceway system.

1. Do not install bends or offsets which are flattened, kinked, rippled or which destroy the smooth internal bore or surface of the conduit.

F. Cap the open ends of raceways during construction to prevent the accumulation of water, dirt or concrete in the raceways. Thoroughly clean raceways in which water or other foreign matter has been permitted to accumulate or replace the raceway where such accumulation cannot be removed by a method approved by the Architect and/or Engineer.

G. Install raceways for parallel feeder conductors with the same physical characteristics and in exactly the same manner. Maintain spacing between raceways for entire run.

H. Do not install raceways which have been crushed or deformed in any manner.

I. Do not install wiring until work which might cause damage to the wires or raceways has been completed.

3.3 UNDERGROUND RACEWAY INSTALLATION

A. Install underground raceways outside of building minimum 24" below finished grade to the top of the raceway.

B. Use select granular fill, free of rocks or hard clumps with sharp or angular edges, for the first 6" of backfill around underground raceways.

C. Install underground raceways minimum 3'-0" from parallel runs, and minimum 1'-0" from perpendicular runs, of underground natural gas and propane lines.

D. Do not use torches to heat PVC conduit for field bends. Do not install PVC conduit that has been scorched by heating for bends.

* END OF SECTION 16110 *

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SECTION 16120 - CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide all conductors for power and lighting as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Provide Copper building wire, minimum #12 AWG, with type THHN/THWN or XHHW 600 volt insulation, except as otherwise noted on the drawings or required by NEC.

1. Provide conductors in underground raceways with insulation approved for wet locations such as type THWN or XHHW.

B. Provide stranded conductors for wires #8 AWG and larger and for terminal connections to all motors. Stranded or solid conductors may be used for sizes smaller than #8 AWG at the contractor's option.

C. Provide conductors rated 90^0 C minimum in wiring channels of Fluorescent and High Intensity Discharge lighting fixtures.

D. Provide conductors with surface printed identification showing conductor size and material, insulation type, voltage rating and approvals at regularly spaced intervals of 24".

E. Do not use sizes smaller than #12 AWG in branch circuits carrying load. Circuits requiring larger sizes to meet voltage drop conditions, etc., are indicated on the drawings.

1. Where branch circuit homeruns indicate conductor size, use that size conductor for the entire branch circuit, including switch legs, etc.

F. Do not use aluminum conductors.

2.2 SPLICES

A. Provide Ideal wirenuts or Scotchlock spring connectors for all conductor splices #8 AWG and smaller. Provide split-bolt or compression type connectors for all conductor splices larger than #8 AWG.

B. Provide splices which are UL listed for the type, quantity and size of the conductors to be spliced.

C. Provide all splices with insulation at least equal to that of the conductor.

D. Provide watertight splices in junction or outlet boxes located outside and in wet locations. Provide heat shrink insulating kits or use connectors pre-potted with an approved waterproof compound.

E. Splice conductors only in approved boxes.

F. Do not splice conductors in conduit bodies, panelboard enclosures, or switchboard enclosures.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all conductors in approved raceway systems.

B. Install branch circuit conductors continuous without splice between fixture outlet boxes, terminals of devices and panelboards.

1. Provide suitable junction boxes in readily accessible locations where splices are necessary at intermediate points of branch circuits. Indicate exact location of all boxes on the As-Built Record Drawings.

C. Cut parallel feeder conductors to exactly the same length for each phase, neutral and ground prior to installing the conductors.

1. Install all phase conductors, neutral conductor and ground conductor in each conduit of parallel feeders.

2. Terminate each conductor of each phase, neutral and ground in exactly the same manner including type of connector and torque tightening of the connectors. Provide multi-conductor lugs for conductor termination where possible, suitable for the quantity and size of conductors.

D. Do not install wiring until work which might cause damage to the wires has been completed.

3.2 COLOR CODING

A. Color code all wiring at each enclosure and box where conductors are accessible and at each splice, tap or termination by means of colored conductor insulation.

1. For conductors #6 AWG and larger, colored self-adhesive tape with the appropriate color designations may be used.

B. Color code each conductor of each circuit as follows.

1. Ground: Green or Bare Copper

2. 120/208 Volt, 3 Phase, 4 Wire System
   a. Phase A - Black
   b. Phase B - Red
   c. Phase C - Blue
   d. Neutral - White

3. Match existing conductor color coding if different than above.

C. Color code switch legs and travelers according to phase with colors other than used for phase conductors, to be consistent throughout the project.

3.3 IDENTIFICATION

A. Provide conductor identification in accordance with Specification Section 16195 - Electrical Identification.

3.4 MULTI-WIRE BRANCH CIRCUITS

A. Where a common neutral is run for multi-wire branch circuits, connect phase conductors to separate phases such that the neutral conductor will carry only the unbalanced current. Use neutral conductors of the same size as the phase conductors unless specifically noted otherwise.

B. Do not install more than three phase conductors in any raceway except where specifically shown on the drawings or approved by the Architect and/or Engineer.

3.5 PHASE ROTATION

A. Phase rotation for Three Phase System will be A leads B Leads C from front to back, from left to right or from top to bottom as viewed from the front of the enclosure.

* END OF SECTION 16120 *

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SECTION 16130 - ELECTRICAL BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide junction boxes and outlet boxes at each outlet, fixture and other device location as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 OUTLET AND DEVICE BOXES

A. Provide galvanized or cadmium plated sheet steel electrical boxes in indoor dry locations, of the most suitable size and shape for the conditions encountered and in accordance with NEC requirements for the number of conductors allowed.

B. Provide minimum 4" Square or Octagonal, 1-1/2" Deep Boxes unless specifically indicated otherwise on the drawings.

1. Provide minimum 4" Square or Octagonal, 2-1/8" Deep Boxes where Three (3) conduit connections are required.

2. Provide minimum 4-11/16" Square, 2-1/8" Deep Boxes where Four (4) or more conduit connections are required.

3. Provide gang boxes where more than one device is located at the same point.

4. Boxes smaller than 4" Square or Octagonal, even though of equivalent cubic inch capacity, are not acceptable.

C. Provide Type FD cast metal boxes outside, in wet, humid or corrosive locations and where exposed to damage such as vehicular traffic.

D. Confer with the various equipment suppliers and either use or properly provide for boxes which are furnished with the equipment, such as speakers, horns, bells, etc..

E. Do not use "THRU-THE-WALL" boxes, sectional (gangable) boxes or non-metallic boxes.

2.2 JUNCTION BOXES

A. Provide junction boxes as specified for outlet and device boxes except that boxes 6" square and larger may be painted sheet steel.

2.3 BOX ACCESSORIES

A. Provide fittings, plaster rings, cover plates and other accessories suitable for the purpose and location of each box.

B. Provide industrial raised covers for surface mounted outlet and device boxes.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Support each box from the building structure independent of the raceway system.

B. Support flush mounted wall boxes with metal bar hangers or metal stud backing behind the box secured to wall studs.

C. Secure surface mounted boxes to building structure with minimum of 2 screws or bolts as required.

3.2 INSTALLATION

A. Install flush mounted boxes, after being equipped with extensions, accessories, etc., flush with finished face of wall, ceiling or floor.

B. Install boxes level and plumb.

3.3 LOCATIONS

A. The wiring system layouts on the drawings are generally diagrammatic and the location of outlets and equipment are approximate.

B. Study all available drawing details, shop drawings, equipment drawings, building conditions and materials surrounding each outlet and device box prior to installing the box to ascertain the exact location required for each box.

C. Rough in the electrical work such that electrical outlets, fixtures and other fittings are properly fitted to the work of other trades.

D. The right is reserved to make any reasonable change in the location of the outlets before roughing in, without involving additional expense.

3.4 MOUNTING HEIGHT

A. Install outlet and device boxes at the heights shown on the drawings or as directed by the Architect. In general, mount outlets as follows.

1.	Convenience Outlet, Indoor	18"
2.	Convenience Outlet, On Roof	24" above roof to bottom of box.

B. All mounting heights, including mounting heights indicated on drawings, are to the center of the outlet box above finished floor or grade unless noted otherwise.

C. Refer to applicable Specification Sections for mounting heights of devices and equipment not included above or install at heights as directed by the Architect and/or Engineer.

* END OF SECTION 16130 *

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SECTION 16140 - OUTLETS AND WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide all wiring devices complete with coverplates and necessary accessories as shown on the drawings and as specified herein.

1.3 SUBMITTALS

A. Provide submittals for each type of wiring device to be used on the project in accordance with Division 1 Specifications and Section 16000 - General Provisions, Electrical to verify compliance with the contract documents.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. Provide wiring devices rated 20 amps minimum, as specified below, or equivalent of Eagle, General Electric, Hubbell, Leviton or Pass & Seymour.

1.	Switch, Single Pole	Bryant 4901
2.	Receptacle, duplex convenience, 3-wire	Bryant 5352
3.	Receptacle, duplex, GFCI protected	Bryant GFR53FT

B. Color of devices in finished areas will be as selected by the Architect from the manufacturer's standard colors to compliment the color of architectural finishes.

C. Provide Gray devices in unfinished spaces such as mechanical and electrical rooms.

D. Provide convenience outlets with GFCI protection in accordance with NEC requirements, where installed outside or within 6 feet of any sink and as indicated on the drawings.

1. Provide a self-adhesive printed label stating "GFCI PROTECTED" for each outlet protected by feed-through GFCI receptacles or GFCI circuit breakers.

2. Use feed-through GFCI outlets only to protect other outlets within sight of the GFCI protected outlet.

2.2 COVERPLATES

A. Provide a cover plate for each outlet and box suitable for the location and function of the outlet and box.

B. Provide blank cover plates for junction boxes and outlet boxes not used.

C. Provide nylon or impact resistant thermoplastic coverplates for outlets and boxes installed in

finished areas, of the same manufacturer and color as the wiring devices.

D. Provide Stainless Steel coverplates for outlets and boxes installed in unfinished areas such as mechanical and electrical rooms.

E. Provide UV Stabilized Polycarbonate, "Raintight While In Use" coverplates with spring return lids and suitable gasket as manufactured by Eagle or Taymac for all devices installed outside or in wet locations.

2.3 ACCESSORIES

A. Equip each outlet with devices suitable for the purpose of the outlet and with means of properly connecting the equipment served, whether or not such devices are specifically mentioned.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Properly locate each outlet to fulfill its particular purpose. Do not install receptacles or boxes inside cupboards, behind drawers, or otherwise so located, as to be inaccessible or unsuited for the purpose intended.

B. Install all outlets and wiring devices flush with face of coverplate, with the coverplate in contact with the finished face of the wall and with mounting strap of device in contact with the outlet box.

* END OF SECTION 16140 *

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SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide suitable supporting devices for all electrical equipment, raceways and components as specified herein and as shown on the drawings.

B. Refer to individual specification sections for additional supporting requirements.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Provide support anchors which will support in tension a minimum of 4 times the weight of the equipment to be supported but not less 100 lbs.

B. Provide wood screws in wood; toggle bolts in hollow masonry units; expansion bolts with lead shield or shot anchors in concrete and brick; and machine screws, threaded 'C' clamps or spring-tension clamps on steel work.

C. Do not use tie wire for support unless specifically called for in individual specification sections.

D. Do not use threaded C Clamps on tapered steel sections.

E. Do not weld supports, equipment, boxes, raceways, etc., to steel structures.

F. Do not use wooden plugs or plastic inserts as a base for supports.

G. Do not use shot anchors or drilled anchors of any kind in prestressed or post-tensioned concrete slabs and beams except as approved in writing by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Secure supporting devices to building structure.

B. Do not install supporting devices with sheetrock or plaster as the sole means of support. Provide proper blocking behind the sheetrock or plaster as required to support equipment.

* END OF SECTION 16190 *

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SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide identification of all electrical equipment, devices, enclosures, conductors, cables, etc., as shown on the drawings and as specified herein.

B. Refer to individual specification sections for additional identification requirements.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Provide engraved laminated micarta or plastic nameplates to identify each panelboard, cabinet, motor starter, disconnect, etc., with the following minimum lettering heights:

1. Switchboards, panelboards, etc. - 3/8"
2. Disconnects, motor starters, etc. - 1/4"

B. Provide Black Nameplates with White Lettering unless noted otherwise, or required to contrast with equipment enclosures.

C. Do not use Dynamo Labels, printed labels, etc., unless specifically called for in other specification sections or approved by the Architect and/or Engineer.

2.2 EQUIPMENT IDENTIFICATION

A. Provide engraved nameplates on the exterior of each Motor Starter, Safety Switch, etc., to include the Equipment Description, Number or Designation, Voltage, Motor Horsepower and/or Full Load Amps and the Circuit from which the equipment is served.

1. Example: ROOFTOP UNIT RTU-1
CIRCUIT H-13

B. Provide engraved nameplates on the exterior of feeder and other major junction boxes and pull boxes to indicate the function of the wiring within the box such as "PANEL 'A' FEEDER" or "FIRE ALARM PULLBOX".

2.3 PANELBOARD IDENTIFICATION

A. Provide one engraved nameplate on the exterior trim of each Panelboard, visible without opening the door, to include the Panel Designation and the System Voltage.

1. Example: PANEL 'H'
120/208 V, 3Ø

B. Provide nameplates on each Branch Breaker of Distribution Panelboards to indicate the Panel or Equipment served by the Branch Breaker and the location of the Panel or Equipment.

1. Example: PANEL 'H'
KITCHEN STORAGE

2. Install the branch breaker nameplates on the wireway cover trim of panelboards. Do not install the nameplates on interchangeable dead-front trims.

2.4 CONDUCTOR IDENTIFICATION

A. Identify each branch circuit and each feeder conductor at each outlet box, pull box, or other accessible location with hand lettering in black India ink in the enclosure to indicate panel and circuit numbers of all conductors in the enclosure.

B. Identify individual conductors with self adhesive printed markers equal to Thomas & Betts "E-Z Code" markers in outlet boxes, pull boxes, or other accessible location according to the circuit number in outlet boxes, pull boxes, etc., at the following locations:

1. Where circuit number of individual conductors cannot be determined by color coding, such as two or more conductors on the same phase.

2. Where more than one neutral conductor occurs, or where the neutral conductor is not common to all phase conductors, identify the neutral conductor according the associated phase conductor(s) circuit number(s).

2.5 PANELBOARD CIRCUIT INDEX

A. Provide a neatly typed index, to include type of load served and the specific location of the load for each branch circuit of each panelboard.

1. Provide a new typed index for each existing panelboard in which branch circuits are added, removed, or modified to reflect all changes in circuiting.

B. Examples

1. Lighting, Southwest Conference Room
2. Lighting, 2nd Floor Conf. Rm and Office 208
3. Receptacles, SW Conf. Rm, west and north walls

C. Do not use room numbers shown on plans, use room numbers or nomenclature assigned to rooms by the Owner. Do not use remarks from panel schedules on drawing, the remarks are for the Contractor's reference only.

D. Include the panel designation and location of feeder breaker serving the panelboard at the top of the circuit index.

1. Example: PANEL 'H'
MAIN IN PANEL 'M', BOILER ROOM

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install nameplates to be visible from normal viewing angles.

B. Attach nameplates to equipment enclosures with stainless steel screws or rivets. Adhesives are not acceptable.

C. Install panel index behind protective plastic covering.

* END OF SECTION 16195 *

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SECTION 16400 - SECONDARY SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16110 - Raceways

C. Section 16120 - Conductors

1.2 SCOPE

A. Provide complete electrical service as shown on drawings and as specified herein.

PART 2 - PRODUCTS

2.1 SYSTEM

A. The Existing Secondary Electrical Distribution System is 120/208 Volt, Three Phase, Four Wire, 60 Cycle for Lighting, Equipment, Appliances and Outlets.

2.2 SERVICE ENTRANCE

A. Provide Overhead Electrical Service Entrance as shown on the drawings from the metering switchboard to a service entrance mast weatherhead mounted not less than 20 feet above finished grade.

1. Secure the service conduit to building structure in accordance with NEC and Power Company requirements to adequately support the overhead service lateral.

2. Leave sufficient length of free conductors (minimum 2 feet) for connection of the Power Company's overhead service drop cable.

2.3 METERING

A. Provide raintight metering switchboard as indicated on drawings, in accordance with Specification Section 16470, and as approved by the local power company.

2.4 FEEDERS

A. Sizes and connection of feeders are shown on the Power Riser Diagram. Feeders are sized to handle rated loads and to meet voltage drop conditions.

B. Do not install conductors of different sizes or types in the same conduits.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate electrical service and metering with local power company prior to beginning work.

B. Arrange with serving utility for proper voltage.

3.2 FEEDERS

A. Before or during final job site observation, check each panel feeder and main feeder for balance of load on each phase, and make necessary adjustments to insure acceptable balance.

3.3 POWER OUTAGES

A. Power outages to any portion of the existing building will not be allowed except on weekends, holidays and/or as directed by the Owner.

1. Submit written requests for power outages to the Owner not less than Seven (7) working days prior to all proposed outages.

2. Do not take any power outages without the Owners permission.

* END OF SECTION 16400 *

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SECTION 16440 - SAFETY SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

B. Section 16475 - Fuses

1.2 SCOPE

A. Provide all disconnect switches required by NEC or local regulations as shown on drawings and specified herein.

1.3 SUBMITTALS

A. Provide shop drawing submittals for each Safety Switch type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include Manufacturer's standard published literature for each switch type. Clearly indicate all options, accessories, finishes, etc., to be provided with each switch type.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

A. Provide NEMA KS1, Heavy Duty Type HD, horsepower rated, quick-make, quick-break enclosed load interrupter knife switches, fusible or non-fusible as required, with externally operable handle, lockable in the OFF position and interlocked to prevent opening front cover with switch in ON position.

B. Maximum voltage, current rating and horsepower rating will be clearly indicated on a metal plate riveted or otherwise permanently fastened to the switch enclosure.

C. Provide switches with NEMA 1 enclosures or where indicated as weatherproof, NEMA 3R enclosures.

D. Provide fusible switches rated 600 amps or less with a UL listed rejection feature to reject all fuses except Class R fuses.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable safety switch manufacturers, subject to compliance with the contract documents, are Challenger, Cutler Hammer, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Provide a minimum of four supports, located at each corner of each switch enclosure. Where the

enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

A. In general, mount safety switches 5'-0" above finished floor or grade to center of switch.

B. For exterior disconnects at condensing units or packaged rooftop units, mount top of switch at the same height as the top of the unit but not less than 24" above grade or roof to the bottom of the switch.

3.3 IDENTIFICATION

A. Provide an engraved nameplate for each switch in accordance with Section 16195 - Identification.

B. Provide adhesive tag on inside door of each fused switch indicating NEMA fuse class and rating installed.

* END OF SECTION 16440 *

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SECTION 16450 - SECONDARY GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Ground all non-current carrying metallic parts of electrical equipment, raceway systems and the neutral conductor of the wiring system as shown on the drawings and specified herein.

PART 2 - PRODUCTS

2.1 GROUND CONDUCTORS

A. Provide copper ground electrode conductors, minimum No. 8 AWG solid. Stranded conductors may be used for sizes No. 2 AWG and larger.

B. Provide an insulated equipment ground conductor in all raceways on the load side of the service disconnect.

2.2 GROUND CONNECTIONS

A. Make the electrical service ground connection at the new main service equipment and connect to existing metallic water service and ground rods as shown on the drawings and in accordance with NEC Article 250, Part III.

B. Bond the neutral conductor to electrical service ground system at the main transformer and the main service equipment only.

C. Bond all interior metallic piping systems to the electrical service ground system.

D. Make above ground connections by means of pressure connectors, compression connectors, clamps or other means which are UL Listed and classified as suitable for purpose.

E. Make all underground connections by means of an exothermic welding process equal to Cadweld or Thermoweld, in strict accordance with manufacturer's written instructions and recommendations.

2.3 GROUND RODS

A. Provide copper ground rods, minimum 3/4" diameter and 10'-0" long, which conform to UL 467, Grounding and Bonding Equipment where indicated on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Leave ground connections accessible for inspection.

B. Install ground rods minimum 8 feet into earth. Space adjacent ground rods minimum 6 feet apart.

C. Provide a separate ground terminal for each ground conductor in each panelboard, switchboard, and similar electrical equipment enclosures.

D. Install all grounding in accordance with the latest edition of the National Electrical Code.

3.2 GROUND RESISTANCE MEASUREMENTS

A. Measure the resistance to ground using the fall-of-potential method described in IEEE No. 81. The resistance values, soil conditions at the time of measurement and the location of each ground rod shall be recorded and forwarded to the Owner and Engineer.

B. If a ground resistance of 25 Ohms or less cannot be obtained with the indicated ground electrodes, provide a supplementary ground electrode consisting of 3/4" x 10'-0" copper ground rods or deep driven sectional ground rods until a resistance of 25 Ohms or less is obtained. Total length of additional ground rods will not be required to exceed 30 feet. Space additional ground rods as evenly as possible and at least 6 feet from any other ground rods.

* END OF SECTION 16450 *

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SECTION 16470 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide new panelboards complete with all necessary accessories as shown on drawings and as specified herein.

B. Provide new branch circuit breakers in existing panelboards to serve new branch circuits as shown on drawings.

1.3 SUBMITTALS

A. Provide shop drawing submittals for each Panelboard and Metering Switchboard in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include dimensioned construction drawings for each Panelboard and Switchboard. Clearly indicate voltage, ampacities, breaker types, conduit entrance areas, materials, options, accessories, finishes, etc., to be provided with each Panelboard. Include Series-Rated verification where required.

1. Include Metering Switchboard literature to verify compliance with referenced EUSERC, ANSI and UL Standards required by local power company.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Provide dead front safety type panelboards, constructed in accordance with NEMA and UL standards, with plated aluminum or copper bus bars.

B. Provide each panelboard with main circuit breaker, single lugs or double lugs for attaching feeder conductors and/or sub-feeder conductors as shown on the drawings.

C. All panelboards to be 20" wide minimum.

D. Provide panelboards with NEMA 1 enclosures unless indicated otherwise on the drawings.

E. Arrange circuit breakers in double vertical row configuration with bolted bus connections.

F. Provide panelboard fronts with concealed indicating trim clamps, concealed steel door hinges and a flush mounted combination latch and lock. Key all locks alike for all panelboards furnished for the project.

G. Provide each panelboard with an approved circuit index holder with transparent protective cover on the inside of panelboard door.

H. Provide a ground bus in each panelboard with a separate terminal for connection of each feeder and each branch circuit ground conductor.

I. Panelboard schedules as shown on drawings.

2.2 METERING SWITCHBOARD

A. Provide deadfront type Switchboard constructed in accordance with applicable NEMA and UL standards, suitable for use Service Entrance Equipment, and totally front accessible.

B. Front covers may be screwed on or hinged with removable hinge pins. Inlcude sealing provisions on all line side covers.

C. Provide switchboard with copper bussing of sufficient cross-sectional area to meet UL Standard 891 temperature rise and braced to withstand a short circuit current of 50,000 RMS symmetrical amperes. Connect bus supports and bus joints with hex-headed bolts and Belleville washers to minimize maintenance requirements.

D. Provide the switchboard with a molded case main circuit breaker for the electrical service disconnecting means. Provide the main circuit breaker with adjustable solid state trip functions to include long time ampere rating, short time ampere pickup and delay, and instantaneous pickup and delay.

1. All trip settings shall be fully field adjustable without the use of separate hand held programmers.

E. Provide utility metering compartment in the service entrance section of the switchboard in accordance with EUSERC 348 and local power company requirements.

1. Provide the metering compartment barriered from all load side bussing with hinged doors, removable hinge pins and sealing provisions. Install wiring to door mounted devices such that doors will swing full open with all wiring installed.

2. Provide meter sockets to meet the requirements of ANSI C12.7, Requirements for Watthour Meter Sockets and 7UL/ANSI 414 Standard for Safety, Standard for Meter Sockets.

a. Provide a 13 terminal, Current Transformer Rated meter socket with drilled and tapped perch for installation of a test switch to meet requirements of EUSERC 339.

3. Metering transformers will be furnished by the Power Company for installation by the contractor..

2.3 CIRCUIT BREAKERS

A. Provide thermal-magnetic type circuit breakers unless noted otherwise.

B. Provide multi-pole breakers with trip elements in each pole and common trip handle.

C. Provide "HACR" rated circuit breakers to serve heating, ventilating and air conditioning equipment branch circuits.

D. Provide "SWD" rated circuit breakers to serve all lighting and outlet branch circuits.

E. Provide new circuit breakers in existing panelboards of the same type and interrupting ratings as the existing circuit breakers. Provide new mounting hardware, connectors, dead front covers, etc., as required to install the new circuit breakers.

F. Plug-in breakers are not acceptable for use in panelboards.

2.4 INTERRUPTING RATING

A. Provide panelboards and switchboards with minimum short circuit current interrupting ratings as shown on the drawings.

B. The interrupting rating of circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short circuit current rating specified for the panelboards.

C. The minimum interrupting ratings of circuit breakers used as feeders and branches may be in accordance with UL 489 tested and certified series-connected circuit breaker combinations. All electrical equipment using the Series Rated circuit breaker combinations shall be clearly marked on the panel nameplate and feeder breaker indicating the same.

2.5 ACCEPTABLE MANUFACTURERS

A. Acceptable panelboard and switchboard manufacturers, subject to compliance with the contract documents, are Challenger, Cutler Hammer, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Provide a minimum of four supports, located at each corner of each panelboard. Where the enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

A. In general, mount panelboards 6 feet above finished floor or grade to top of panel.

B. Where panelboard exceeds 6 feet in height, arrange the panelboard so that the top operating handle does not exceed 6'-6" above finished floor or grade.

C. Floor mount switchboards on 3" high concrete housekeeping pad and secure to floor and wall or structure.

3.3 IDENTIFICATION

A. Provide nameplates and neatly typed circuit index for each panelboard and switchboard in accordance with Section 16195 - Electrical Identification.

* END OF SECTION 16470 *

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SECTION 16475 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide fuses of the proper sizes and rating for each fusible switch as shown on the drawings and as specified herein.

PART 2 - PRODUCTS

2.1 FUSES

A. Provide UL Class L or UL Class R, current limiting fuses, rated for up to 200,000 amperes interrupting capacity.

1. For branch circuits feeding motors, furnish UL Class RK5, Time-Delay fuses and for branch circuits other than motors, furnish UL Class RK5 non time delay fuses.

B. Provide fuses which are a standard product of Bussman, Cefco, Gould/Shawmut, or Reliance.

2.2 SPARE FUSES

A. Provide a 20 percent complement, but not less than three, of each rating of each type of fuse used on the project. Turn over spare fuses to the Owner prior to Substantial Completion.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install only fuses of the same type and rating in each fusible switch.

3.2 COORDINATION

A. Coordinate fuse sizes for packaged mechanical equipment with mechanical contractor. Provide fuse sizes as indicated on the equipment nameplate.

* END OF SECTION 16475 *

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SECTION 16480 - MOTOR STARTERS AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide motor starters, pushbutton stations, and other necessary operating devices for all Motors and Equipment as shown on the drawings and as specified herein.

B. Thermostats and similar control devices and control wiring for control of heating, ventilating and air conditioning equipment will be furnished and installed by the Controls Contractor under the provisions of Division 15 Specifications.

1.3 SUBMITTALS

A. Provide shop drawing submittals for each Motor Starter in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include Manufacturer's standard published literature for each starter type. Clearly indicate all sizes, ratings, control devices, options, accessories, finishes, etc., to be provided with each starter.

PART 2 - PRODUCTS

2.1 MOTORS

A. Unless otherwise noted herein or on the drawings, motors will be furnished under Division 15 Specification Sections.

B. In general, motors 1/2 HP and smaller will be Single-Phase rated at 115 or 120 volt. Motors and equipment larger than 1/2 HP will be Three-Phase with nameplate rating of 200 or 208 volt when used on a 120/208 volt system.

2.2 MOTOR STARTERS

A. Provide NEMA rated motor starters and control devices.

B. Do not use IEC rated motor starters and control devices.

2.3 MANUAL MOTOR STARTERS

A. Provide Square D Class 2510 type F, or equal, single phase manual motor starting switches with overload heaters for each single phase motor where indicated on drawings.

2.4 MAGNETIC MOTOR STARTERS

A. Unless otherwise noted herein or on the drawings, motors starters will be furnished under Division

15 Specification Sections as part of packaged mechanical equipment.

2.5 ENCLOSURES

A. Provide starters with NEMA 1 Enclosures where located in indoor normally dry locations.

B. Provide starters with NEMA 4X enclosures where located in outside or in wet locations. Provide suitable drain for starters located outside in accordance with the manufacturers written instructions.

2.6 HEATER CHARTS

A. Provide manufacturer's standard chart inside the door of each starter indicating overload heater types, sizes and ratings for the starter.

2.7 ACCEPTABLE MANUFACTURERS

A. Acceptable motor starter manufacturers, subject to compliance with the contract documents, are Allen Bradley, Challenger, Cutler Hammer, Furnas, General Electric, Siemens, and Square 'D'.

PART 3 - EXECUTION

3.1 SUPPORTS

A. Provide a minimum of four supports, located at each corner of each enclosure. Where enclosure exceeds 36 inches in any dimension, provide additional supports at 24 inches on center maximum.

3.2 MOUNTING HEIGHT

A. In general, mount individual motor starters 4'-0" above finished floor or grade to center of starter.

3.3 COORDINATION

A. Give special attention to wiring and controls for two-speed motors or motors with special controls at no additional cost to the Owner.

B. Determine exact location of all electrical devices controlling mechanical equipment in cooperation with the Mechanical Contractor in the field before roughing-in.

* END OF SECTION 16480 *

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SECTION 16500 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplemental General Conditions, Division 1 Specification Sections and Section 16000 - General Provisions, Electrical apply to work of this section.

1.2 SCOPE

A. Provide all lighting fixtures, as shown on drawings and as described herein, complete with all necessary wiring, sockets, lamps, auxiliaries, supports, etc..

1.3 SUBMITTALS

A. Provide shop drawing submittals for each Fixture and Ballast type in accordance with Division 1 Specifications and Section 16000 - General Provision, Electrical to verify compliance with the Contract Documents.

B. Include Manufacturer's standard published literature for each fixture type. Clearly indicate all options, accessories, finishes, etc., to be provided with each fixture type.

PART 2 - PRODUCTS

2.1 FIXTURES

A. Provide fixtures which comply with the appropriate Underwriters Laboratories (UL) Standards for the fixture type and which are UL Listed and UL Labeled.

B. Acceptable fixture manufacturers and types are indicated on the Fixture Schedule included with the Drawings.

1. Listing of the manufacturer's catalog numbers on the Fixture Schedule is intended to establish the general fixture type required and does not relieve the contractor and/or supplier from the responsibility to provide all accessories and options included in the fixture description nor from meeting the requirements of this specification.

2.2 HIGH INTENSITY DISCHARGE (HID) BALLASTS

A. Provide UL Listed, High Power Factor, High Intensity Discharge (HID) Ballasts which conform to the applicable ANSI Designation for the wattage and type of lamp served.

B. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type, UL listing and Date of Manufacture Code.

C. HID Ballasts shall contain no PCB's.

D. HID Ballast Warranty shall be 2 Years from the "Date of Manufacture" Code on the ballast.

2.3 LAMPS

A. Provide lamps of the Wattages, Types, and with color characteristics as indicated on the Fixture

Schedule included with the Drawings.

B. Provide High Intensity Discharge (HID) lamps suitable for the installed burning position which conform to the applicable ANSI designations for the wattage and type of lamps specified on the drawings.

C. Acceptable Lamp Manufacturers, subject to compliance with the Contract Documents are General Electric, Phillips, Sylvania and Venture.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install new fixtures as shown on the drawings.

B. Where lighting fixtures are shown to conflict with locations of structural members and mechanical or other equipment, provide adequate supports and wiring to clear same.

3.2 SUPPORTS

A. Provide all necessary connectors, straps, etc., for secure mounting of all fixtures.

3.3 LAMP BURN-IN

A. Burn-in all HID lamps for a minimum of 100 hours prior to completion of the project and replace all defective lamps.

3.4 COORDINATION

A. Coordinate fixture locations with other contractors to provide adequate clearance between fixtures and ductwork, piping, structural members, etc., for proper installation of fixtures and provide access for maintenance or replacement of the fixtures.

* END OF SECTION 16500 *